The Quarterly

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Signs of Progress. The detailed figures covering building operations in the cities of the United States during 1909, as compiled by the Government Geological Survey, contain many facts and comparisons of interest. The statistics are those of 128 cities, so that the aggregates may be said to represent practically all of the urban construction in the country.

It was a great building year, both relatively and actually, the total expenditure for this purpose in the cities coming very little short of a billion dollars—$930,520,713. It is interesting to find that Chicago led in the number of new stone structures and also in the number of concrete; that New York led in brick and Seattle in the number of wooden buildings. But Chicago, for all her stone and concrete, spent more for wooden buildings than did even Seattle. Reading, Pa., was the only city in the country that reported no wooden buildings. New York led in the construction of fire-resisting structures, these coming to a cost of nearly a hundred and eighty-two million dollars; Chicago was next, with an expenditure for them of seventy-nine millions; Brooklyn third, at fifty-four and a half millions; and then Philadelphia, St. Louis and San Francisco.

Taking the new building as a whole, all over the country, 73.24 per cent of the total expenditure was for fire-resisting structures—an encouraging showing.

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Sprinkler Tank Collapse. About the best hour that could be selected for an accident in a theatre is 6 a. m., at which time the sprinkler tank at the West End Theatre in Manhattan collapsed. This tank was bound with flat hoops, which are invariably quickly weakened by corrosion which attacks the under side where it may not always be seen. The condition of these hoops was, however, known, and it was evidently the policy of the owner or lessee to wait for things to happen, before making improvements. The following facts are furnished by a Manhattan member:—

"At 6 a. m., July 18, 1910, without any warning the 5,000-gallon sprinkler tank, elevated twelve feet above roof of stage portion, collapsed, and staves and contents of tank fell on roof over stage, on auditorium roof, on roof of adjoining flat house and on to street.

"The rush of water across stage roof carried four staves over the three-foot parapet wall and down to sidewalk of Hancock Place, together with a 6-foot length of 2 1-2 x 16-inch marble coping. Fortunately no one was passing at the time, as this is a drop of 75 feet. A large quantity of water entered skylight and fell to center of stage.

"The tank was of cedar, installed in 1902, and constituted the only water supply for the sprinkler equipment over the stage portion. There were nine ordinary flat hoops on tank, the bursting of one of which must have caused all remaining hoops to give way simultaneously.

"An examination of hoops after accident shows that they were as thin as paper in many places, and it is remarkable that a collapse did not occur long before this. The attention of the occupants had been called to the condition of these hoops as far back as June, 1906, but they did not feel disposed to make any change.

"Damage will be approximately $500, not including cost of new tank."

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Look After the Heater. About as reprehensible a bit of carelessness of which a householder may be guilty is that of letting his furnace stand all summer in the condition left by the last fire in spring. The smoke pipe should invariably be taken down to avoid destruction by rust from the moisture in the air currents that otherwise pass through it all summer.

In any event the heating equipment should be carefully overhauled before a fire is started in it. This precaution seems doubly imperative in the case of public buildings heated by hot air furnaces.

A portion of the inspection force of the bureau of surveys of the New York board of fire underwriters was recently assigned to the inspection in the metropolitan district of churches exclusively. In accordance with this idea the following letter was issued, calling attention to safeguards against fires in churches:—

"The frequent fires each year in churches, due to defective heating and lighting equipments, emphasize the importance of a special warning at this particular season, when heating equipments are being put into service after disuse since spring. We, therefore, respectfully solicit your co-operation in our efforts to reduce the fire waste in churches and accessory buildings, such as rectories, assembly halls, schools, colleges, hospitals, asylums and charitable institutions. In this connection we ask that you have all heating equipments carefully inspected in order that any repairs, if needed, may be made before the advent of cold weather. In like manner all lighting systems should be inspected and repaired. Defective heating and lighting devices, together with carelessness in the handling of motors, fuel, packing material, paint and general refuse, have caused the majority of fires in churches. Systematic supervision of these features will, therefore, prevent many church fires. Our experts on the subject of heating and lighting apparatus will call occasionally to inspect your equipments and offer suggestions, if any seem warranted. They will be sent to any church upon request made of us for that purpose. We bespeak for our inspectors your hearty co-operation in these matters of mutual interest, which involve the protection of life and property against fire.

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Apartment House Hazard. A Western correspondent sends us the following note on a new fire hazard now being found in apartment houses of the better class, especially in Pittsburg and vicinity:—

"Laundry driers, heated by direct natural gas flame, are being installed in the basements and are generally constructed of galvanized iron placed directly on the floor, and having about a six-inch clearance to the ceiling joists. Two burners of perforated

pipe are placed longitudinally under the floor of the drier. This floor is made of two layers of sheet metal about one inch apart, the under one, immediately exposed to the burners, is perforated, permitting the flame to come in contact with the upper layer. On the floor inside the drier is laid a wire netting, about one-fourth mesh, not raised sufficiently from it to prove a safeguard in case clothing should fall from the racks to the floor. The racks are of the ordinary sliding variety, made of metal, common to driers of the class used in small steam laundries. The operation of this device is left largely to domestics of the various families occupying the apartments, and is in almost constant demand, sometimes being permitted to run all night. The general disregard of ordinary precautions in the installation of these driers, together with instantaneous water heaters (which are peculiar to Pittsburg), when not provided with proper connections to flues and chimneys, contribute a hazard not heretofore contemplated."

The growing congestion of population in all the large cities makes artificial drying of clothes a necessity, and the high value of space in relation to rents makes the temptation to install such drying equipments in out-of-the-way corners of basement and attic very great.

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Independence Day Hazards. There has now elapsed since July 4th time enough in which to compile the statistics of this year's accidents due to our special manifestations of "patriotism," and although the list of deaths and accidents due to the celebration is still appalling, the "sane" observance of the day this year shows a notable improvement in this respect. The decrease in accidents is most marked in those sections where restrictive legislation has been put in effect, says the *Journal of the American Medical Association*. The summary shows:—

"On July 4 this year 2,923 persons were injured, of which 131 died. Sixty-seven deaths were due to tetanus, nineteen were killed outright by firearms, eleven by explosions of powder, bombs or torpedoes, six by cannon or similar contrivances, while twenty-six, mostly little girls, were burned to death by fire from fireworks.

"Startling as this showing is, it is the best since 1903, when the *Journal* began keeping its record. In 1903 4,449 persons were injured, of which 466 lost their lives, 406 of them dying from tetanus.

"The grand total for eight years shows that 37,526 persons have been injured at Independence Day celebrations. Of these 1,662 died, 604 as the direct result of their injuries and 968 from tetanus following injuries. One hundred and twenty-two persons have lost their eyesight, 551 have lost the use of one eye, 432 have lost the use of arms, legs or hands and 1,541 have been crippled by the loss of fingers.

"The detailed figures for 1910 show 72 cases of lockjaw, 67 of which were fatal; seven persons lost their sight, 33 lost one eye, 26 lost arms, legs or hands and 114 lost their fingers.

"The decrease from 1903 to 1910 is due to more intelligent methods of celebration, the most marked decreases occurring in states where the agitation for restrictive measures was most urgent. Massachusetts had this year only one-seventh of the injuries it had the previous year; Missouri, New Jersey and New York reduced their injuries to one-third; Illinois and Ohio to one-half; Pennsylvania reduced its injuries to two-thirds of last year; Indiana, Iowa and Wisconsin show larger totals than a year ago."

It is obviously the duty of the last three states, and all others which have not done so, to take up this matter at once, before the manufacturers of fireworks begin to plan their commercial operations for next year.

Rubbish-Choked Basements. In a recent interview with the *New York Tribune*, Fire Chief E. F. Croker demonstrated clearly that the tenement-house laws regarding the storage of combustible materials are being grossly neglected in that city. Many cellars in dingy-looking east side tenements, as well as those of the better apartments, are packed with masses of paper, rags, wood and broken furniture, all of which make excellent material for fire. In 1908 there were in New York 1,551 fires caused by lighted matches, and a big percentage of these were traced to the accumulation of inflammable matter in basements. There are now in Greater New York some 103,837 tenements, in many of which live twenty-four families. From authoritative statements it is believed that five-sixths of this number, or 86,000, have dangerously kept basements. A late report of the fire chief states that "in many of them there are dyers and cleaners using naphtha; upholsterers, excelsior and other fibers; printers, benzine; plumbers, gasolene; painters, dangerous liquids and solids; drug stores, chemicals; and there are also in many of these buildings dealers in matches, fireworks, gunpowder and cartridges." A report of the fire department for 1909 shows that there were 12,441 fires in Greater New York during that year, with a total damage of $7,431,635. Chief Croker estimates that 3,000 of this number were due to carelessness in enforcing tenement-house regulations, and might have been avoided were it not for rubbish-choked halls and basements.

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Forest Fires. The recent frightful loss of life and property by forest fires should be sufficient to stir both our own and the Canadian state and national governments to vigorous action. New York and New England have already taken steps to insure the use of oil-burning locomotives in forested parts, and at a recent meeting of the forestry committee of the Canadian Commission of Conservation, the question of fires due to railways was taken up, and a number of recommendations made. Among other things, the committee suggested that in every case in which a fire is started by sparks from railway locomotives, and either begins outside of the right of way or spreads therefrom to adjoining land, the company shall be liable to a fine of $1,000 unless the railway company shows that it has used upon the locomotive the best available modern appliance for preventing sparks from spreading therefrom, and that no negligence has been shown by the engineer or firemen of the locomotive or any other servants of the company, and that the company has maintained an efficient staff of fire rangers. The committee further recommended that the act respecting government railways be amended to provide for an efficient staff of fire rangers, and that the government railway shall provide free transportation for all provincial fire guardians. It was also recommended that the committee again press upon the attention of the Dominion government the desirability of taking immediate action to form a reserve of forest lands on the

east slope of the Rocky Mountains and afford efficient fire protection for the same.

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Concrete Weakened by Fire. An interesting note comes to us from the West on the effect of fire upon the strength of a concrete floor. The building in which it occurred was of reinforced concrete and brick, and original estimate of loss was made on the basis that the concrete floors and ceiling were not damaged sufficiently to be torn down. The owner refused to accept these figures, claiming that the concrete had been damaged and weakened. He requested that the building be tested by putting on a weight of 400 pounds to the square foot, and if the flooring deflected more than three-sixteenths of an inch, same was defective and would have to be removed. This was the original test made by the architects when building was completed and turned over to the owner.

A panel fourteen and one half by eighteen and one half feet in the northeast corner of the building was first tested, and when a weight of 250 pounds to the square foot was put on, the floor deflected five-sixteenths of an inch. Another panel was tested, and a deflection of four-sixteenths of an inch to 250 pounds was noted. There were eight panels, all approximately fourteen and one-half by eighteen and one-half feet, which were involved in the fire, and as a further test it was decided to try one panel in another part of the building which had not been damaged by the fire, in order to see how the same would show up. The sand used for testing was therefore removed to this panel, and with the same weights, viz., 250 pounds to the square foot, this panel did not deflect over three thirty-seconds of an inch. The test seems to demonstrate the virtues as well as the defects of concrete construction. As there were about 60,000 pounds of powdered drugs burned, a tremendous heat was created which would have meant a total loss to the building had it been of any other construction. At the same time, there is indicated by these tests a defect in concrete which it may be impossible to overcome, and that is, that the reinforcing steel used in its construction undoubtedly expands under a certain heat, causing the concrete to weaken.

The Publicity Campaign.

"Conservation of Utilized Resources from Destruction by Fire" was the subject of the address at the St. Paul (Minn.) Convention, September 5 to 9, by the special committee of the National Board of Fire Underwriters. The committee was composed of Messrs. A. W. Damon of Springfield, Mass., George W. Babb, Charles G. Smith, W. N. Kremer and R. Emory Warfield of New York, R. M. Bissell of Hartford and R. D. Benson of Philadelphia.

As is always the case with messages from this body, the paper was admirably conceived and forcefully and convincingly written. The matter has already had wide publicity, but we desire to make a portion of it a part of our permanent records:—

"'The present fire waste in this country is an unnecessary national calamity and to reduce it it is essential—

"'First.—That the public should be brought to understand that property destroyed by fire is gone forever and is not replaced by the distribution of insurance, which is a tax collected for the purpose.

"'Second.—That the states severally adopt and enforce a building code which shall require a high type of safe construction, essentially following the code of the National Board of Fire Underwriters.

"'Third.—That municipalities adopt ordinances governing the use and keeping of explosives, especially inflammable commodities and other special hazards, such as electric wiring, the storing of refuse, waste, packing material, etc., in buildings, yards or area ways, and see to the enforcement of such ordinances.

"'Fourth.—That the states severally establish and support the office of fire marshal and confer on the fire marshal by law the right to examine under oath and enter premises and to make arrests, making it the duty of such officer to examine into the cause and origin of all fires and when crime has been committed requiring the facts to be submitted to the grand jury or proper indicting body.

"'Fifth.—That in all cities there be a paid, well-disciplined, non-political fire department adequately equipped with modern apparatus.

"'Sixth.—That an adequate water system with proper distribution and pressure be installed and maintained. In the larger cities a separate high-pressure water system for fire extinguishment is an absolute necessity to diminish the extreme imminence of general conflagrations.'

"The National Board of Fire Underwriters has for years persistently endeavored to influence the introduction of improved and safe methods of building construction, to encourage the adoption of better fire protective measures, to secure efficient organization and equipment of fire departments, with adequate and improved water systems, and to have adopted rules regulating the storage and handling of explosives and inflammable products; and we contend that successful efforts along these lines will very largely lessen the fire waste of the utilized resources, the destruction of which at the rate of over $216,000,000 annually (1900-1909, inclusive) is one of the greatest drains upon our natural resources and one which can be corrected, if the nation, state, city and citizen will co-operate along the lines indicated above.

"The destruction of our utilized resources by fire is increasing at such a rapid rate that the subject of its reduction should be very prominent in the minds of the people. Losses recorded for the past 35 years, not including forests, mine or marine fires, total the enormous sum of $4,906,619,240. Unrecorded losses, if obtainable,

would materially increase these figures. These annual fire losses run from $64,000,000 in 1876 to $518,000,000 in 1906. In 1907, a normal year, our recorded losses were $215,084,709, and our estimated fire defense cost $241,401,191, or a total amount equalizing about 50 per cent of the value of the new buildings erected that year in the entire country. In 1908, also a normal year, our ash heap cost $217,885,850 and the relations of defense cost and fire loss to new buildings remained about the same. Our contributions to fire that year were over 1¼ million dollars each day of the year, a sum equal to the operating expenses of our government, including those of our army and navy, for the same year; and in 1909 we gave to fire over $25,000,000 more than was spent in that year for the same governmental functions.

"No one organization can effect the needed reform. Since 1880 the population has increased 73 per cent while the fire loss for the same period increased 134 per cent. The National Fire Protection Association and the National Credit Men's Association are spreading the doctrine of reform in the recklessness with which our utilized resources are destroyed by fire. Each organization should be encouraged. Membership in the former is open to all and in the latter to the business men and merchants of our cities.

"If the citizens of a community, as members of their local civic bodies and boards of trade, will create in such organizations a committee of fire prevention, whose duty it shall be to study the subject and awaken among their associates a realization of individual and communal responsibility, and if our boards of education will emulate the action of the State of Ohio in prescribing primal education of the school children as to the chemistry of fire, the causes of fires in our homes and how to guard against them, and how to extinguish incipient fires or hold them in check while awaiting the response of the fire department, a preparation will be made in that community which will check the constantly increasing fire waste.

"And so while this conference discusses and formulates policies for the conservation of our natural resources, it should, at least, as representing the official, professional, commercial and industrial life of the nation, distinctly and emphatically advocate such regulation as will preserve those resources which are the embodiment of the thrift and industry of our people—the utilized resources—from unnecessary and wasteful destruction by fire."

Per Capita Fire Losses for 1907 in the United States

(United States Geological Survey.)

Geographic Division—	Fire Loss Per Capita.
North Atlantic—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania	$2 50
South Atlantic—Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida	2 19
North Central—Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas	2 37
South Central—Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas	3 66
Western—Montana, Wyoming, Colorada, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, California	2 65

Fire Losses in Six European Countries

Country—	Years.	Annual Average.	Population, 1901.	Loss Per Capita.
Austria	1898-1902	$7,601,389	26,150,597	$0 29
Denmark	1901	660,924	2,588,919	26
France	1900-1904	11,699,275	38,595,500	30
Germany	1902	27,655,600	56,367,178	49
Italy	1901-1904	4,112,725	32,449,754	12
Switzerland	1901-1903	999,364	3,325,023	30

Average loss per capita, 33 cents.

President W. H. Merrill delivered an address at the annual convention of the International Association of Fire Engineers at Syracuse, N. Y., in August, and made certain revelations regarding the character of public department fire hose that are of vital interest to every one having property to protect. He said in part:—

"As showing some of the work we are doing, I will place on record with you our conclusions reached as a result of tests of sample lengths of new cotton rubber lined public department fire hose sent in from lots recently delivered to a number of departments in different sections of the country. The tests were made under specifications referred to as a minimum standard by the manufacturers engaged in this industry. We are prepared to admit that a higher standard for this material should be set.

"The results of extended tests and examinations of sixteen different brands of fire hose received from fire departments in the far West, the Central West and the East, show important deficiencies in all, and clearly indicate that, almost without exception, these are of such inferior quality that they should not be accepted for use in a public fire department. While the brands investigated are by no means equally poor in quality, there is hardly a feature relating to the materials employed or the details of manufacture which does not merit criticism with more or less frequency, considering the tests as a whole.

"The most important defect and the one most commonly present relates to the quality of the rubber linings employed. Extended analysis shows that the percentage of gum used varies from about twenty-six (26) to fifty-two (52) per cent, and that it is almost universally of inferior quality. In only two cases could any claim for high grade rubber have been justified and these did not fully meet the minimum standard considered essential for this important class of service. Compounds which may contain pure gum even of high grade are often admixed with reclaimed rubber or shoddy and mineral oils and low grade gums are commonly employed."

Mr. Merrill then went into detail in his criticisms commenting on the results found in tests of the rubber lining, the cotton fabrics, the cement backing and the couplings of the hose, as well as the physical tests, including the bursting strength. Continuing, he said:—

"The defects found in the cotton fabric used in the hose tested, while important in many instances, were generally of secondary importance compared with those relating to the rubber portions of the hose. Wide variation was noted in the degree of excellence in weaving as well as in the character of the finished product. Very little, if any, long staple cotton could be identified, that most commonly employed being not more than one inch in length. Considerable difference in the grade of the cotton was also apparent.

"Fabric was commonly employed which contained unsightly and injurious defects which by the greatest stretch of imagination could not be classified as incident to the best practical manufacturing. Some brands of hose having the best grades of rubber noted were provided with fabric which would cause doubt as to possession of machinery capable of producing a proper fabric, or which would indicate intention to furnish an inferior article. Other brands having inferior grades of rubber linings, were provided with strong, evenly woven fabric regarding which no criticism could be offered as a result of their performance in the hydrostatic pressure tests.

"The defect next in importance and which was present in the hose tested to a very marked extent, relates to the character of the surface of the waterway and the influence of this on the efficiency of the hose. This appears to be a point which is almost universally neglected, but it is perhaps unnecessary to call your attention to the disadvantages of hose introducing friction losses over fifty per cent in excess of the normal loss for hose manufactured by the best methods. Under certain conditions, excessive hydraulic friction losses may have a very important influence on the degree of protection obtainable at time of fire.

"In practically all cases, and particularly where the hose was provided with hand-made lining, the cement backing was thin and insufficient to properly fill the interstices between the fillers and reduce the corrugations to a minimum. In the

majority of cases the lining was provided with a heavy backing for from two to four feet back from the couplings and was fairly smooth in these portions, the balance of the length being badly corrugated.

"In all but three cases the hydraulic friction loss was in excess of the allowable loss for good hose. In six cases the loss was excessive, amounting to over twenty pounds per hundred feet with 250 gallons per minute flowing, and reaching a maximum of 25.7 pounds in one case. At the higher velocities, the difference between the allowable loss and that obtained in the tests of this hose generally increases quite rapidly. The allowable loss for good hose with 250 gallons per minute flowing is 15.1 pounds per hundred feet of hose.

"It has been claimed that the hose furnished is as good as municipalities are willing to pay for, and that the lower grades are sufficiently reliable for smaller cities where the service is not severe. A comparison between the prices paid and the quality of the hose furnished does not seem to bear out the first contention, for the best hose is frequently sold for the lowest prices, and hose of the poorest quality often sells at the highest prices. Then, again, hose of substantially the same quality and bearing the same distinctive manufacturer's markings, sells for prices differing by wider margins than can be accounted for by any difference in locality or legitimate cost of selling.

"Careful consideration of the second contention and a study of the different conditions of service in the various cities, does not indicate the necessity or propriety of using hose of inferior quality in the smaller cities, even though it may be conceded that the service is not so severe. There is even some reason for the belief that the better grades of hose are more necessary where it is infrequently used, and the service is not severe.

"The results of our investigations serve to show that fire departments generally are not obtaining a proper quality of fire hose, and that there is a marked tendency to employ inferior materials and to slight all of the details of manufacture of this most important part of fire department equipment.

"It is, unfortunately, a fact that it has been most distinctively 'American' for municipalities to purchase materials on the representations of interested parties, and to often accept assurances as to their quality without proper investigation as to the facts in the case.

"The statement is frequently made that the manufacturer knows more about hose than do those who purchase it. Up to a certain point this may be true, but there should be no mystery about what constitutes a proper quality of hose for use in public fire departments and no question about its being received when purchased.

"I may, perhaps, be pardoned for expressing the opinion that the present general practice of purchasing hose by brand or trade name, under a short-term guarantee, and the failure to use and enforce adequate specifications, are chiefly responsible for the present unsatisfactory condition of fire department hose.

"Under the guarantee system, the hose dealer need only figure on a quality of hose just about good enough to last during the term of the guarantee, and, should the competition be severe, a few replacements during the term could probably be made at less cost than to furnish hose which would not have to be replaced. The guarantee serves to conceal the real merit of the product. Behind it the quality of materials and workmanship may be manipulated with but little regard for the interests of the purchaser. It covers only defects of manufacture, and the more important matter of damage resulting from the failure of hose is, of course, not comprehended. The term of the guarantee has been gradually reduced, and three years is now commonly accepted.

"While there is undoubtedly much to be said on the other side of the question, relative to abuses of the guarantee and regarding conditions which may have led to the present unsatisfactory state of affairs, the following remedy, although involving more direct responsibility on the part of fire departments or municipal authorities, would undoubtedly result in securing a proper fire hose. The remedy is as follows:—

"First.—Totally abolish all forms of guarantees.

"Second.—Adopt standard specifications properly covering each essential item entering into the manufacture of fire hose.

"Third.—Secure impartial, thorough enforcement of such specifications before acceptance of the hose.

"Fire hose is certainly of sufficient importance in the economy of things to warrant an equal position with, if not precedence over, other industries in securing a proper grade of rubber. The natural increase in cost occasioned by the use of better materials will be more than offset by the increase in the durability of the hose, and, most important of all, by the increased security against possible losses compared to which the cost of hose is negligible."

Secretary Wentworth spoke at the Forty-first Annual Meeting of the Underwriters' Association of the Northwest, at Chicago, October 7th, and pointed out the potential value of the municipal fire department as an inspection corps. He said in part:—

"The reason for the prevailing mistaken public notion that the National Fire Protection Association is an insurance organization is purely psychological. The American people, in their profligate neglect of their own common life and interests, recognize with difficulty the functions of public organizations which do not have their roots directly in self-interest. In their ignorance of the undermining economic effect of the excessive fire waste upon their own individual lives, the people vaguely wonder why anybody except insurance companies should be concerned about checking fires! It is to the questionings of this common ignorance that we are so frequently obliged to reiterate the fact that the National Fire Protection Association is a public body, and that the fire insurance companies are not responsible for its utterances and should not be embarrassed by being charged with them. Such insurance men as are in our membership are there because they are honestly interested in reducing the fire waste and wish to co-operate in checking it; but this fact is equally true of the architects, engineers, mill owners, merchants, warehousemen, and all the other classes of citizens who contribute their annual dues to our organization's support.

"The mental habits of a people are a vital factor in affecting its growth in social progress. For example, it is the mental habit of our people to assume that fire departments are maintained for the exclusive purpose of extinguishing fires. It is obvious, however, that fire departments have large possibilities for service in preventing fires; a service which is, I regret to say, yet largely potential. Every fireman, from the chief engineer down to the drivers and pipe men, should be regularly detailed for inspection service. Three or four hours a week for each man, going into basements, attics, courts and alleys, keeping down accumulations of rubbish—which spring up over night—locating the storage of inflammable oils and explosives, would keep the city as clean as a hound's tooth. Every fireman should in turn cover every section in the course of six months. One would thus check up the inspections of the other, and local conditions would become a matter for educative conversation about headquarters.

"There is, however, a most important result to be achieved by such an inspection system over and beyond keeping the city clean; and that is the education of the fire-fighters in the exact physical character of the city. To know exactly which passageways are open and which are closed; to know which are fire-walls and which are not; to have a mental picture of the exposures, the windows, the roof openings, the cornices, and all the other physical details important in fire-fighting, would so heighten the team work of a department that like expert swordsmen they could make their thrusts, without loss of time, straight at the vulnerable part.

"There are a few cities in America—Richmond, Va., is one—where such a practice, partially in effect, has already demonstrated its singular efficiency. The citizens of every town and city in the country should demand this sort of service from its fire department, which, I am sure, will be quite willing to assume the larger function and responsibility once it is pointed out.

"The National Fire Protection Association realizes that fire prevention is fully as important as fire extinguishment, and that quite as much thought should be devoted to it. No conflagration can be caused by the fire which, to use a Hibernicism, is 'put out before it starts.' Proper care, both public and private, would achieve this result in over fifty per cent of the fires now reported from day to day. Once a fire is started, no one

on earth can safely predict the moment of its extinguishment. Too many elements of hazard and chance enter into fires in America to allow thoughtful people to remain complacent as to their origins."

Another member, Mr. George E. Bruen, also spoke at the meeting of the Underwriters of the Northwest, on "Theory and Practice in Electrical Inspection" and said some very interesting and helpful things on this subject.

After dwelling upon the beginnings of electrical inspection work he spoke regarding such a department as follows:—

"In such a department there will be recruited a staff of trained inspectors who will be drilled and instructed in the rules set forth in the National Electrical Code, and in their application to every conceivable phase of interior wiring. In the selection of these men extreme care is requisite, for not only must they have a thorough knowledge of the subject-matter of their routine work, but they must also possess a considerable degree of tact, of force of character, and of other essential qualities. They must be men capable of being inspired with a sense of the real importance of their work to the end that in due season there shall develop among them that 'esprit du corps' without which all organized effort is perfunctory in the manner of its performance and ineffective in its result.

"Of almost equal importance is the organization of an office force and the formulation of an office system competent to handle the correspondence and the recording, indexing and filing of the mass of inspection records which accumulate with astounding rapidity in even a small department. This system is based upon the principle of written record of every item of fact pertaining to the inspection of each separate building in the territory covered. These records are so correlated that in a moment's time the electrical history of any building can be placed in evidence and conveniently referred to. Through every step of the process the part taken by each employee concerned, from the inspector down to the file clerk, can be identified so that each can be held responsible for any error or omission which may be noted in the record.

"In what degree the electrical inspection department is responsible for the confidence which is felt by the general public in the present methods of installing interior wiring, and therefore in the growth and development of the vast industry which you gentlemen so well represent, I will not undertake to state, but this claim can be substantiated from the records of more than one electrical inpection department within my personal knowledge; viz., that fires from electrical causes in certain sections of the country are of recent years decreasing, almost to the vanishing point, and furthermore, that in buildings in which the electrical equipment since its inspection and approval has been undisturbed by unauthorized and unskilled parties, such as apartment house janitors, etc., the number of fires from electrical causes is even less, and in some years absolutely none are recorded."

Mr. William T. Benallack, manager of the Michigan Inspection Bureau, spoke upon the "Fire Waste" at the meeting of the Michigan Association of Local Fire Insurance Agents at Port Huron, Mich., August 30th, pointing out the opportunities and responsibilities of the local agencies regarding the national ash heap.

Secretary Wentworth is to speak at the annual banquet of the Association of Credit Men at Newark, N. J., Thursday evening, November 17th.

Publicity Bureau Bulletins.

Note.—By recommendation of the Executive Committee that the general membership be brought in touch with the Publicity work of the Association there are printed below sample bulletins which have been transmitted to N. F. P. A. correspondents for publication in local newspapers. Members and correspondents are at liberty to quote from these articles, or reprint the same entire, without reference to the Quarterly.—Editor.

Bulletin No. 10. Wind-Driven Fires.

March and April, the months of high winds, have come to represent months of apprehension to the dweller in the American city. A century ago when we were yet largely a seafaring folk clinging to the coast line of the Atlantic, a bad night on land was "a bad night at sea." With the passing of the sailing craft and the scattering of our people across the continent, we have attained a new consciousness.

The father of the family now looks furtively out into the dark night of the high wind and inwardly ejaculates, "a bad night for a fire," adding perhaps the hope that none of his neighbors has a defective chimney, or that none of his neighbors' children will drop a kerosene lamp in going to their beds.

The inevitable consequences of an unlimited supply of lumber in a new country are becoming manifest. We are coming unconsciously to take it for granted that sooner or later every American city will have its conflagration with its attendant suffering, and nameless horrors, and death.

A fire on a windy night—this has come to be the common fear. It may well be so, for its justification is manifest. What city in America could foretell, while Chelsea was burning, that in the book of fate was then written the names of Dallas, and Fort Worth, and Manchester, and Rochester, and Lenox? Our profligate fire waste—nearly ten times the European average—is so stupendous that we have in a sense lost the faculty of being horrified by it.

The Fort Worth conflagration was the worst that Texas has ever known. Fully 2,000 persons were made homeless, and practically all of these lived in the finest houses in the city. Broadway, a wide avenue with a wide parkway, containing trees and flowers, and with both roadways paved with asphalt, and which at noon one day had homes on either side, the next day had not a single vestige of property of value left upon it. Fire and a forty-mile wind care no more for the hundred-thousand dollar home than for the workers' tenement.

It was the misfortune of Manchester, N. H., that a fire should start in a locality filled with inflammable buildings while a March gale was

sweeping over New England. Here it was the workers' homes that suffered. Two thousand men, women and children were glad to escape with their lives. An area nearly a mile long and three blocks wide was swept clean. Compared to the Fort Worth conflagration the money loss was not great; but the human suffering and inconvenience were as manifest in one place as in the other.

In Rochester, N. Y., forty houses were destroyed, hundreds made homeless and scores thrown out of employment by the burning of an entire business block. It was Rochester's second bad conflagration within five years.

In Dallas, Texas, seventy dwellings were licked up by the conflagration. The high wind carried burning brands from the Briggs Sanitarium into half a dozen different blocks, setting five or six fires separated by considerable distances. A singular chance started this Dallas fire on the same day of the Fort Worth conflagration, while part of the Dallas fire department was absent helping to subdue the flames in the sister city.

The horrors attending the Lenox, Mass., conflagration, in which six persons lost their lives, overshadow the property loss; although here the fire destroyed four business blocks, two dwellings and two other structures, destroying values of half a million. This, too, was a wind-swept fire.

It is a singular fact that additional great losses were obviated in each of the cities of Fort Worth, Dallas and Lenox only by the shifting of the wind.

There is not a city in the country which does not offer the conditions of a serious conflagration to a fire which once gains headway on a windy day; and yet these conditions are being everywhere steadily duplicated by the erection of poorly constructed frame buildings, and equally bad brick buildings without suitable fire walls or fire stops, or proper window protection.

Nothing except the final exhaustion of our supply of available lumber would seem destined to check the era of American improvidence in housing our families and our wealth in such structures as challenge the wondering comment of the intelligent European. Wind-driven fires in Europe are of rare occurrence because they are intelligently guarded against; first by buildings which are in themselves fire retardants, and second by adequate fire protection.

Bulletin No. 11. The Fire Hazard of Politics.

The truth of the statement that there is a fire hazard in politics, although but vaguely comprehended by the average citizen, comes oftentimes with distinct emphasis to those interested in maintaining municipal fire departments in a state of high efficiency. Politics may interfere directly by forcing fire chiefs to fill their ranks with men physically incapable, and sometimes insubordinate,—and also, indirectly, by tampering with the building department in such manner as to allow the flagrant disregard of most needful precautions.

Modern American communities moved by the fear of conflagrations, and recognizing the fact that fire insurance is a tax and not a generous reimbursement of loss from some other planet, are giving thought to the shocking fire waste of the United States, as a preliminary step toward checking it.

The reiteration by engineers and architects of the claim that over fifty per cent of the $250,000,000 per annum paid by Americans for an ash heap may easily be saved by a few common-sense precautions, is beginning to receive public attention. With this end in view it is evident that in the first place our building methods must be better. This, in the modern city, means suitable building laws, and a suitable building department, in which shall be employed men who know what good building is. Some of the most shocking municipal scandals of the country which the "muck-rakers" have dragged into the light, have had their source in the building departments of certain of our large cities. Neglect or incompetence in this department hides itself under a fair exterior, waiting for a fire to disclose it. A dishonest or politically influenced inspector may pass unfit structural material which he knows will be hidden from sight by evening, taking his chance that the accident will not reveal his culpability until he is beyond punishment. The integrity of our building depends upon the enforcement of such precautions as experience in fire prevention engineering has proved essential. This demands public servants who know their business and who are so secure in their positions as not to fear intimidation from the selfish property owner or his political representative. It is clear that politics in the building department is a distinct and far-reaching fire hazard, offering as it does innumerable opportunities for the evasion on the part of influential individuals of the duties and responsibilities which they owe to the collective life.

The possibility of harmful political influence does not pass from a city, however, once it is well built. Proper building construction is a vast help toward immunity from fire; but there are hazards which cannot be disposed of permanently with the issuance of the building certificate. It is of course difficult for an outsider to select any individual fire and say of it that it would have been sooner extinguished, or extinguished with smaller loss, had the firemen been of better character; but many a fire chief might have ideas upon the subject did he chose to utter them.

It is certain that a high degree of efficiency in fire fighting cannot be attained by men who have proven their uselessness in all other callings and who may get a berth in the fire department through political influence. In the larger cities this danger has been minimized by placing the fire department, as well as other departments of the public service, in the hands of non-partisan commissions. In the medium-sized city, however, the fire chief himself may be dismissed by an incoming administration. This naturally makes him a politician; lessens his dignity in the eyes of his men, impairs discipline and generally reduces the virtue of the organization of the department. In many of the smaller cities there are practically

no ordinances covering the storage of explosives and the storage and use of petroleum and its products—the fire chief is the sole arbiter. Under such circumstances, if his berth is political, he will be wary of offending the local hardware magnate who desires to keep a stock of dynamite in his cellar, or the local grocer who may not care to bury his gasolene tank. In many cities an intelligent public opinion has secured the adoption of good building ordinances, good laws covering the storage of oils and explosives, and other regulations calculated to protect life and property from fire; but has found that the local politician can walk unimpededly through such regulations at will.

However, it is evident that the awakening public consciousness regarding the needless fire waste of the country must stimulate inquiry into all such matters, and lead eventually to such action as will secure to American communities the public protection that is essential to common safety. It is difficult to believe that there will finally be any consent whatever to the admission of politics into a department of the public service upon the integrity of which the life of any citizen may at any moment depend.

Department Stores.

By Winthrop P. Tenney (Member N. F. P. A.)

Department stores are a product of our modern civilized life. They are a natural growth of the individual store presided over by an ambitious, energetic owner. Just when the ordinary store takes on the added dignity, if such it be, of a department store is hard to say. Perhaps four or five diversified departments under one head of general management may constitute a department store, in a strict acceptation of the word, but it has been customary to designate as department stores only those immense structures housing 50 or more departments, containing large numbers of clerks, accountants, buyers, salesmen and other employees, and it is only with such stores that this paper deals.

It has been said that anything may be found in the large city department store, and this is in the main true. The goods exposed for sale in all department stores are not necessarily of the same grade. A department store is essentially a store for the multitude; a "popular" store catering to the tastes and purses of all the people, and each differs in the quality and grade of goods sold. Anyone familiar with the stores in his city can classify them as high, medium and low-grade stores, according to the quality

of goods sold and the class of trade supplied. The character of the department store has little influence on the fire risk, provided the management is first-class.

Processes and Stock.

General retailing, with its attendant processes, is the principal work done in department stores. To give some idea of the usual departments and stock exposed for sale, the following list may be given as fairly representative of all department stores, though each store often has its specialty: general dry goods and small wares, furniture and house furnishings of all kinds, pianos, pictures and framing, ladies' and gentlemen's clothing and wearing apparel (including tailoring and altering), boots and shoes, millinery, crockery, glass and china ware, toys, books, kitchen ware, leather goods, harnesses, groceries, curtains, carpets, rugs and awnings, music, phonographs, medicine and toilet articles, printing, wall paper, etc. Outside the regular work of selling is the mechanical work—repairing, carpentering and electrical work made necessary by the constant deterioration and change in the various departments.

It should be remembered that much of the stock displayed is of a highly inflammable nature and as variable in character as celluloid comb stock, ammunition or calcium carbide are from crockery, china and glassware. The stock is nearly all susceptible to water damage and breakage, or may be ruined by smoke. So that with the large values subject to even an inextensive fire, and the accompanying destruction from smoke or water, the resulting loss may be very large.

Construction.

The construction of department stores is of the utmost importance, more so perhaps than that in any other form of building. The older and smaller stores are usually located in inferior buildings, often renovated for the purpose. Walls are brick, with joist floors and ceilings plaster sheathed throughout. They often have concealed spaces at roofs, and sometimes pitched roofs. New department stores in congested districts are now usually of fire resistive type. They have brick or stone facing on iron frame, with reinforced concrete or terra cotta floors and roofs. This is the only suitable type of building for department store occupancy. The large amounts of inflammable stock which these stores contain, and their location, render them sources of potential danger often underestimated by the layman.

In the older stores practically all the floor openings, such as light wells, stairways and passenger elevator, form open shafts extending from basement to roof, which are extremely dangerous in case of fire. Store managers have always pleaded that the enclosing of these openings would seriously interfere with the commercial success of the store. They believe that a light open store is a necessary feature, enabling the customers to obtain a wide view of the stock exposed for sale, and they strenuously

object to enclosing these vertical openings. Without entering into a discussion on this point, we wish to say that since the advent of wired glass there is no excuse for allowing such dangerous openings to exist. Polished wired glass gives a very satisfactory method of enclosure without greatly obstructing the view which they claim is so important. Modern stores are now using this material for light shafts, passenger elevator and stairways, and in time we may see this serious vertical hazard entirely disappear. Freight elevators are almost always located in brick wells with fire doors at each floor. Bundle chutes, which are circular metal chutes connecting each floor with packing and shipping room, should have heavy self-closing doors at each opening.

Curtain boards, so-called, have a certain importance in risks equipped with automatic sprinklers when the value at stake does not warrant a large outlay for wired glass, or when the enclosure of a main staircase may be felt to be a detriment to the business. These drops may be made ornamental, and should project below ceiling around the openings at least eighteen inches. They serve to bank up the heat from any fire on a floor, thus causing the sprinklers to operate more quickly, and prevent others on the floors above from opening unnecessarily. They are of no positive value in preventing the spread of a fire, however.

The floor area of the department store is another factor which may greatly influence the spread of fire. Experience suggests the necessity of making the undivided area not greater than ten thousand square feet, and where large floor areas are necessary fire walls should be introduced with fire doors at the openings. Here again we clash with the ideas of department store managers, who prefer to have a large unobstructed area over which a customer's eyes may roam at will. Where a department store has an established trade with regular patronage, limiting the area is not so important to them. New stores, however, may need this additional help. The fact that department stores are successfully run in London, with fire walls cutting them off at frequent intervals, seems to disprove the theory so common in America that an unobstructed area is necessary.

Curtain boards might also be used in these cases, and offer some slight protection by preventing the heat from passing quickly throughout the floor area and causing an abnormal number of sprinkler heads to open in a comparatively small fire. They are of no certain value, however.

Exposure.

Many department stores have succumbed to exposure fires. This is not surprising, when we consider that they are usually located in highly congested districts. While it is difficult, if not impossible, to protect such a building from a sweeping conflagration, it is perfectly practicable to protect it against an incipient or moderate conflagration.

This can be done in the usual manner of protecting the heavily exposed windows by shutters and the others by wired glass or open sprinklers.

Fire Record.

The National Fire Protection Association has records of 269 department store fires, which have been classified as follows:—

FIRES.	No. of Fires.	Per cent of Fires.
Occurring in waste or rubbish of various kinds	70	26
Unknown	65	24
Defective electric wiring, many from temporary wiring in show windows	49	18
Employee fires, due to carelessness of store employees, mechanics, etc., with a few due to carelessness of shoppers	31	12
Exposure	17	6
Kitchens connected with restaurant or candy kitchen	11	4
Boiler or power plants	10	4
Stoves, defective flues or chimneys	9	3
Spontaneous combustion in furniture rooms	5	1
Incendiary	1	..
K. O. lamp exploded	1	..
	269	

Special Hazards.

Disposal of Waste Paper and Wrapping Material. Waste paper is without doubt the source of many fires in department stores. Hardly a year passes but the larger department stores have anywhere from one to five fires in this waste or from packing or shipping refuse. The large stores have considerable trouble in disposing of this waste satisfactorily and at the same time keep the unpacking and shipping portions of the store neat and clean.

This waste comes from opening original packages containing excelsior or hay and wrapping-paper. Besides, it is necessary to have on hand the same materials for the proper crating and shipping of goods sold.

In the large stores paper waste and rubbish are brought to the waste chute and dropped to the vault in basement. The chute and vault are usually of fireproof construction. The waste paper is sorted from the rubbish and baled, as it has a certain value. The rubbish is burned either under the boilers or, in the larger stores, in specially constructed furnaces.

Waste chutes sometimes have special devices for holding the waste when inside the chute until the door can be closed. Then by turning a handle the bottom of the device drops and the waste falls to the bottom of the chute. Heavy iron drop doors, closing by gravity, should be used, unless some special automatic closing device, such as is mentioned above, is used. The door at bottom of the chute should be automatic and preferably of the standard fire door type.

Excelsior or hay for packing goods sold should be stored in a metal lined or fire-proofed box, with cover kept closed when not in use. It is needless to say that no smoking should be allowed in the shipping room or anywhere throughout the building.

Electricity. Defective electric wiring is the cause of many fires, among which are some of the largest department store fires. There is no question but that electric lighting is a vast improvement on other forms of lighting, and it is reasonable to believe that were old methods of lighting, such as lamps or gas, still in use in department stores that the number of fires, due to lighting, would be greatly increased. When we consider that most department stores are literally a network of wires carrying electrical energy, and that the least deviation of the current from its proper path means a short circuit and possibly an abnormal heating anywhere on the wires, perhaps in concealed spaces, it is quite evident that if such wiring is poorly or improperly installed the chance of a fire starting is very great. The electric wiring, supervision of material and equipment can never be too closely watched. No temporary wiring should be allowed unless installed in a similar manner to permanent wiring.

General Utility and Repair Department. Every department store employs a number of general utility men for repair work, carpentering, electrical work, sweeping and supervision. Small changes in the location of booths, partitions, counters, etc., often serve to keep several carpenters busy. Electric lighting changes, temporary wiring, turn-tables for show window displays make it necessary to employ several electricians. Elevators, escalators and other machinery need to have repairs promptly made when out of order, so the repairing force is augmented by mechanics of various kinds. Window and booth decorators are specially trained men and have small rooms containing supplies of paints, oils and other material necessary for the effects they desire to obtain. It is almost impossible to obtain men who are always careful and can be certain of exercising good judgment. These men are often responsible for starting fires, owing to their inability to foresee results or a general "don't care" attitude. Fires due to these men can never wholly be eliminated, but many can undoubtedly be prevented by a strong, aggressive management. On the other hand there are many managers, as well as employees, who cannot be taught to understand the value of careful, intelligent work and supervision. Carefulness and good judgment, the great preventive of such fires, are natural to the man and may not often be taught or acquired.

Kitchens and Restaurants. Every large department store, more particularly in the cities, has a considerable space devoted to restaurant purposes, where customers may obtain food during the day. The kitchens run in conjunction with these restaurants are a source of accidental fires due to carelessness, inattention of employees or stoves and ranges improperly installed. These fires are usually of small importance.

Stoves and ranges are ordinarily heated with coal or gas, and deliver the hot gases of combustion into well arranged flues and chimneys. Coffee urns are heated by gas or steam. These culinary appliances, to be safely installed, should be set on zinc or sheet iron, leaving an ample air space between the zinc and the flooring. The air space and the large radiating surface serve to diffuse the heat so that it is carried away by air currents

before the flooring or walls are dangerously heated. It is much better, however, to set stoves or ranges, or indeed any receptacle continuously heated, on cement or other non-conducting or non-combustible surface. Flues and chimneys should be examined every few years for cracks due to settling or deterioration of mortar.

The Power Plant. The size and complexity of this portion of the department store depends wholly on the size, number and character of departments in the store itself. Power plants of the modern department store in the large cities are extremely complete and complex, while the smaller stores may have only boilers for heating the store and pumps for elevators. The equipment of a large modern store comprises besides boilers, engines with generators and dynamos for electric lighting, and motors for elevators and escalators, water and air pumps for cash-carrier system or elevators, fire pumps, refrigerating machinery run by auxiliary engines for fur storage and perishable goods, artificial ice making, show cases, soda fountains, etc. One does not ordinarily think of these power plants as specially dangerous, but if we stop and consider that here is the source of the entire mechanical energy of the store,—that here natural forces are in a state of transformation to other forms of energy,—it is readily seen that it is quite essential that all this machinery should be of the best and, above all, be well installed and cared for. As this may not always be the case, the best arrangement, when possible, is to have all such machinery in a separate power building. It is seldom possible, however, that the congested location necessary for the successful department store admits of this. So we are forced to be content with the installation of power plants in the main building, usually in basement or sub-basement. The power room should, in any event, be of fireproof construction and thoroughly cut off from the remainder of the store. This is as much for safety of customers as for fire protection. Boiler explosions are not infrequent in isolated factories, and there is no reason why they may not occur in department stores. The loss of life from a catastrophe of this description is awful to contemplate. Most of the fires, reported as occurring in power plants, have been of minor importance and due to carelessness of installation or to neglect.

Furniture Cleaning, Rubbing and Polishing. Many of the department stores have a complete furniture department, where there is not only a large display of valuable furniture, but where furniture is repaired and repolished. Whole floors are often devoted to displaying the various styles and varieties kept in stock, and it is always necessary to keep the furniture polished and clean. Every store having a furniture department uses small amounts of varnishes, alcohols, turpentine, linseed oil and shellac, and unless general repairing is done, which is not generally the case, these inflammables are kept in close proximity to the department. They can best be cared for in a vault located near the department, and careful supervision should be given the polishing rags. They should be removed every day and burned.

Altering and Repairing Clothes. Such a department is always main-

tained when the store deals in ladies' or men's custom or ready-made clothing, for the convenience of customers. There are a few small hazards in such a department. Cloth shrinking machines or irons are either gas or electrically heated, and should be carefully arranged so that gas or electricity may not be left on over night, thus overheating any devices and causing a fire. A red pilot light with a master switch, if electricity is used, or a telltale light with master valve, if gas, in care of the foreman of the room, should insure sufficient care of this hazard. Small amounts of benzine are used. If this is kept and used from safety cans, and no large amount kept in the room, no trouble may be anticipated.

Upholstering. Not every department store has such a department, but they are frequently found in the larger stores. Hair, feathers or moss are picked or opened up by machinery, generally in a small room on the roof. As this is in the nature of ordinary picking, a fire might occur in these machines if any foreign substance struck a spark while the machine was running. Pressing irons and benzine are often used in this department, and to be satisfactorily installed they should be arranged as stated above.

Fur Storage. This service is furnished by most of the large department stores, and in recent years has grown rapidly. Insurance companies are interested principally from the fact that this room, usually of a comparatively small size, often contains enormous values, and a fire occurring inside or communicating to this room is liable to cause large loss. These rooms should be constructed of fireproof material, the insulating space being filled with mineral wool or other equally insulating non-combustible substance. Racks and pegs for hanging furs should be of metal. The lighting of this room should be by stationary electric incandescent lamps, having all circuits controlled by switch outside the room. A small fireproof room adjoining should contain brine coils from refrigerating system, and air may be circulated throughout the room by slow moving fan controlled from outside. Special devices, such as sprinklers and thermostats, should be installed here, also thermostatic control of fan, so that any fire raising temperature abnormally would shut down the fan automatically. Temperature should be recorded on a thermometer in engine room with automatic notification if temperature increases unduly.

Fire Protection.

In considering fire protection of the department stores we must keep in mind their construction and location, as well as the public service character of these buildings. These points are of more than ordinary importance, and especially noticeable if contrasted with the average factory. The owner of the average factory may choose many equally good sites for building. His factory may be completely isolated, or have only light exposure. He need not give special consideration to fire resistive construction, but may erect a factory which best suits his business and the capital that he wishes to invest. While he is responsible for the safety of his

employees, their comparatively small number renders their satisfactory protection something to which he need give little thought.

Not so with department stores. The department store is a public service store. It tries every way to attract visitors, hoping to make them customers. In inviting and seeking to attract these people to enter the store, it accepts a great moral responsibility for their safety, and is bound to take every precaution against fire or any extraordinary accident which will in the smallest degree give rise to a loss of public confidence. It is appalling to think what might occur in any department store thronged with thousands of holiday shoppers should a fire become the cause of panic among the customers.

The large department stores usually realize the value of modern fire protective practices, and stand ready to adopt any device or method which will insure less liability from fire, or which will afford any additional means of fire protection.

First and foremost, no matter what the construction of the department store, there should be an installation of automatic sprinklers well supplied by water works, batteries of pressure tanks and steam pumps. Alarm devices should be installed in the sprinkler systems operating electric gongs in suitable places, and in addition a complete thermostat system under daily test, giving alarm at a central station when there is any undue rise of temperature in any part of the building. A further system of supervisory connections on sprinkler gate valves, and other sprinkler system devices, insures their being kept in proper order, and gives an alarm at a central station if such is not the case.

Watchmen are employed, and make hourly rounds through the property, ringing in regular stations on a clock or at a central station.

The installation of standpipes, roof hydrants and monitor nozzles, hand chemicals and fire pails, completes the rather complex and, it may seem, cumbersome protection inside the building.

The outside protection usually consists of wired glass windows, shutters and open sprinklers co-operating with the public fire department. A fire brigade, composed of employees, well drilled and familiar with the various fire fighting devices, trained to extinguish small fires, allay the fears of customers, prevent unnecessary loss by water from sprinklers and co-operate with the public firemen, is a necessary and valuable aid to fire protection.

The value of well built, self-supporting brick walls, blank and parapet, wherever possible, must not be overlooked as fire protective features against both incipient or sweeping conflagration, as well as their effect in limiting fires in the stores themselves. There is nothing equal to or of more value than a good brick wall of this description, and it should be given full prominence in any scheme of fire protection in city buildings.

The Life of an Automatic Sprinkler.

By C. R. Alling, Assistant Engineer, Underwriters' Laboratories, Inc.

The life of an automatic sprinkler is not indefinite under any conditions, and under certain conditions it may be comparatively short. The sprinkler fire record would be even more favorable than at present were this more generally known and proper precautions taken to protect sprinklers from influences detrimental to their operation. The automatic sprinkler is generally recognized as the most effectual fire extinguishing agent yet developed, and considering all that it has to contend with in the way of faults in design, errors in construction, mistakes in installation and mistreatment in service, it is surprising that its general showing is so favorable. It is surely deserving of better supervision, care and maintenance.

The object of this article is to point out a few of the more common causes of failure of automatic sprinklers which have come under the attention of the engineers at the Underwriters' Laboratories, in the hope that persons interested may co-operate with the Laboratories toward an advance in the state of the sprinkler art, particularly that portion of sprinkler practice for which building owners and occupants are chiefly responsible.

Up to the present time no sprinkler has been designed which will prove entirely reliable when exposed to very severe loading or corrosive conditions for long periods of time. The life of some types of sprinklers is longer than others, due to their more perfect design or excellence in manufacture, thus increasing their ability to better withstand these influences. Also, the life of some types of sprinklers will be longer where there are no corrosive atmospheric conditions than other types for the same reasons. Thus it will be seen that the life of a sprinkler depends on the excellence of its design and construction, as well as upon the influence of surrounding conditions.

Some types of sprinklers were, in the early days of manufacture, made of cast iron. These were unduly susceptible to influences of corrosion, and experience soon taught the pioneers of this industry that most all parts of a device of this character should be made of metals which would be least subject to deterioration and, therefore, for the last twenty-five years, practically every manufacturer has employed brass, bronze, or some similar alloy, which will be the least affected by conditions to which an automatic sprinkler is normally subjected. At the present time there is probably not a sprinkler in service in which the more essential parts are made of any material other than bronze or some other copper-tin alloy.

Tests conducted at the Laboratories upon old sprinklers taken from

the field, and having been in service for varying lengths of time, show that the greatest and the most common causes of failure are corrosion and loading. Corrosion usually acts upon the solder, changing the chemical composition upon the surface and forming a crust. Continued exposure will sometimes entirely disintegrate the solder and weaken the members. This is especially so in the early types of sprinklers. A good example of how continued neglect will result in an absolute failure of the sprinkler can be seen in Figure No. 1. This sprinkler had been in service about ten years over a dipping tank in a plating establishment, and apparently no means of protecting it from the surrounding conditions had been provided. In this sample the solder was entirely eaten away, the parts being held together

Figure 1.

Sprinkler inoperative: Solder entirely eaten away; parts held together by the corrosion.

by the corrosion, and the sprinkler being absolutely inoperative. Even if the releasing device had operated during a fire the distribution would have been inadequate, as the deflector had been destroyed by corrosion.

A large number of sprinklers have been tested at the Laboratories from equipments where the corrosive conditions are fairly severe, such as paper mills, stables, fertilizer plants, tanneries, dye houses, sulphite mills, aniline works, soap factories, etc. These tests indicate that no sprinkler

will remain in good condition indefinitely, and that the only way in which it can be determined whether the heads are in a reliable and operative condition is to test representative samples under conditions that may be met with at time of fire. It has been found in a number of instances that although the sprinklers appeared to be in fairly good condition before the test, they were absolutely inoperative, while in other cases the corrosion appeared to be sufficient to render the heads inoperative, but upon test they were found to be reliable.

Various attempts have been made by the sprinkler manufacturers to protect heads which were to be installed in locations unusally subject to

Figure 2.

Sprinkler inoperative: Loaded and clogged with paper pulp.

corrosive influences, but none of these have been entirely successful. One method consisted in covering the entire sprinkler above the wrench head with a glass cap, the idea being that the heat from a fire would either be sufficient to crack the glass or else the heat would be transmitted through the glass to the soldered joint so that when the releasing device operated the water pressure would be sufficient to blow off the cap. The principal objection to this was that the sensitiveness of the sprinkler was materially decreased.

Another method which is probably more successful consists of coating

all parts of the sprinkler with mineral wax compositions having melting points below that of the ordinary degree solder, so that in case of fire the composition will melt and leave the parts free from corrosion before the heat becomes sufficient to fuse the solder. This method of protecting the sprinklers has generally given satisfactory results for a limited time, the principal defect being that under severe conditions the coating dries out or becomes cracked by expansion and contraction, thus allowing the corrosion to work in and attack the metal parts. No successful method of protecting high degree sprinklers has yet been devised.

Sprinklers located in plants where they are subject to loading will become inoperative in a comparatively short time, the clogging effect of the loading being often just as effective in rendering the sprinkler inoperative

Figure 3.

Sprinkler inoperative at pressure of 100 pounds.

as severe corrosive influences. This is evidenced by tests of sprinklers taken from various mills where they were subjected to loading from paper pulp, sawdust, drying oils, lint, caked dust from grinding processes, etc., etc. The character of the loading is somewhat different in almost all cases, varying from a thin hard crust to a thick, heavy, fibrous coating. All of these loadings tend to accomplish the same result; *i. e.*, to clog the parts so that the releasing device cannot operate freely, if at all. Figure No. 2

shows the condition of a sprinkler received at the Laboratories for test. This head was taken from a paper mill and was entirely covered with paper pulp.

Probably one of the most frequent objections that an inspector makes in looking over an equipment is to the coating of the heads with paint or calcimine. In calcimining or painting a ceiling there is great danger of the sprinklers becoming slightly coated; and if this should occur at the soldered joint of the releasing device, the sprinkler, especially if it is one of the older types, is very liable to be in a questionable condition. Its appearance may not indicate its true worth, and its reliability can only be determined by suitable tests.

Many of the equipments at present in service are provided with sprinklers which at the time of installation were probably as good as could be obtained, but do not now come up to the present state of the sprinkler art. These heads, even when new, were not always entirely reliable, and the years that they have been in service have accentuated their defects. For example, one type of sprinkler that was manufactured about 1898 was so designed that the levers of the releasing device are nearly on dead center, the result being that when the solder on the link becomes oxidized or slightly corroded or loaded, there is not sufficient motive power to operate the parts of the releasing device. Figure No. 3 shows one of these sprinklers, which was inoperative at a pressure of 100 pounds even after the fusible link had been removed.

On the other hand, other types of sprinklers have been manufactured in which the off-center distance of the levers was great, resulting in an abnormal strain on the soldered joint, the head finally opening prematurely. It is essential that the sprinkler be so designed that it will safely withstand the stress to which it is normally subjected, and at the same time insure a sharp reliable release of the parts under all reasonable conditions of service. These features have been embodied to a greater or less extent in all the more modern sprinklers.

The life of an automatic sprinkler depends primarily upon its design, accuracy in workmanship, and ability to retain sufficient motive power, independent of water pressures, to overcome all reasonable obstruction to its free operation for extended periods. Tests made at the Laboratories upon old sprinklers indicate that inaccuracy in the machined surfaces and bearings are largely responsible for the slow actions of the releasing device, resulting in partial opening of the link, and in some cases the resealing of the solder by the water. This is caused by a slight set between the parts, and consequent loss of the motive power necessary for the proper operation of the parts. The more modern sprinklers contain features which increase the chances of the releasing device operating favorably, or aid in its continuous movement. In some cases the frames and levers are so designed that when the desired load is placed on the link or strut, only a portion of the elasticity is utilized, thus retaining the necessary power for the free and reliable action of the releasing device when the fusible element operates. In other

cases, springs, diaphragms, etc., have been incorporated to insure the proper operation of the parts. In one of the earlier types of sprinklers, which was approved quite generally, the design was such that after its operation the link could be replaced in the sprinkler as installed in the piping. This permitted a stock of fusible links to be kept on hand for replacements, when necessary. This led to misuse in the field; and when this supply was exhausted, or not easily found, the two arms were frequently wired together and, as a result, the sprinklers were entirely inoperative.

Another feature that was not entirely realized in the early types was the freedom of release of the caps and discs from the seats. A large number of sprinklers are in service at the present time which are open to these most important defects, and the only way in which these may be detected is by laboratory tests. In some sprinklers lead and other soft metal discs were formerly employed, and after having been in service for a short time it was found that the seat ring gradually became embedded to such an extent that the sprinkler was rendered inoperative, the cap remaining on its seat even under very high water pressures. Cases are on record where pressures in excess of 150 pounds were necessary to release the cap. Recent tests of another type of sprinkler show that the caps and block tin discs have become wedged in the discharge orifice, so that pressures in excess of 100 pounds are required to release them after the link and lever portions of the releasing device have operated. Also in this same sprinkler, the caps have released satisfactorily, but the perforated block tin discs adhered to their seats, requiring velocities produced by pressures of 150 pounds to force them off. The opening through these discs is three-eighths of an inch, and as a result the water discharged is reduced about 50 per cent under normal conditions.

From the foregoing it would appear that property owners, as a rule, need to be brought to a realization of the fact that the life of an automatic sprinkler is not indefinite. The need for replacing old, obsolete and injured heads should be constantly borne in mind. The exercise of care and intelligence in making such replacements is, of course, essential. That more and more attention is being paid to this important matter is evidenced by the constantly increasing volume of examination and test work made at the Underwriters' Laboratories on specimen heads sent in from equipments in the field. Thorough tests, such as are conducted at the Laboratories, are perhaps the only true criterion on which action should be based, in the majority of cases, and as these tests are made promptly and without charge there would seem to be no justifiable reason for depending on field tests or less thorough analytical work than the Laboratories conduct. Automatic sprinklers are, of course, sometimes found in service which will manifestly fail under ordinary fire conditions, but in the majority of cases, the demarkation between reliability and unreliability in the device cannot be accurately made except by Laboratory tests conducted by men trained in the business.

Factory Oil Houses.

By Charles E. Worthington (Member N. F. P. A.)

From the very beginning of things, which is to say from the earliest preachments of the pioneer apostles of fire prevention and fire protection, it has been urged upon manufacturers in all cases where oils do not enter into the product as an important ingredient, that safety and expediency require the segregation of these substances.

The term "oils" is here used in the broadest sense to include all of the commoner hydrocarbons, volatile or non-volatile, and includes alcohol, turpentine, carbon bisulphide, kerosene and naphtha, as well as lubricating or tempering oils.

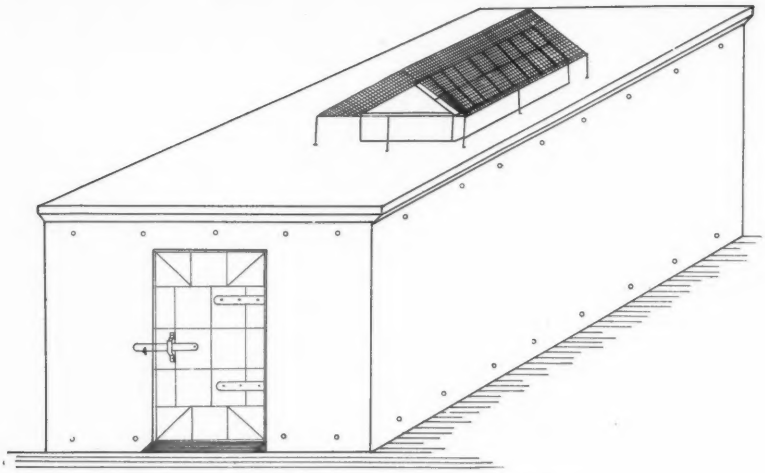
While it is quite true that many of these are not subject to spontaneous ignition, yet even in these cases the tendency of conditions usually attendant upon the storage and drawing are such as to favor accidental fires. Many that do not give off explosive vapors at ordinary temperatures do so in large volume when but slightly warmed, practically all are highly combustible under certain conditions, and once ignited burn with great persistency, resisting water to a greater extent than most other substances.

That the storage and handling of oils is a considerable hazard is rarely dissented from, when taken as an abstract proposition, and in the case of volatile oils, *i. e.*, those giving off ignitable or explosive vapors at ordinary temperatures, the general disposition to isolate the storage and handling has come to be expressed by rather stringent insurance regulation and state and local legislation.

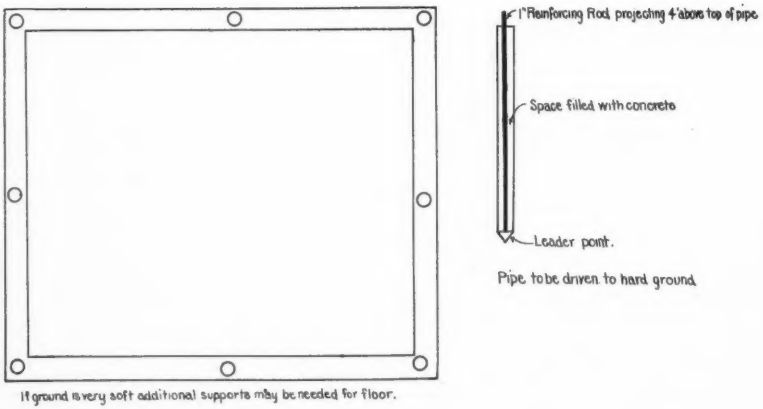
But since factories are built for profit and the time and the convenience of employees is a factor in the cost of production and volume of profits, if the isolation of any particular substance is productive of serious inconvenience or involves any considerable loss of time the general disposition, while admitting the hazard, is to consider the hazard the lesser evil and at least tolerate it on that ground.

The matter of providing comparatively safe storage and handling for such oils as are necessarily kept within the factory has received exhaustive attention and a standard of construction for rooms for this purpose adopted. These (inside) oil rooms, however, are intended solely for such moderate quantities as are required to be kept for immediate or daily use, the main supply being understood to be kept elsewhere.

The location of an oil storage house, if of combustible construction, so near a factory building that its burning endangers the main structure, while unquestionably better than storage and handling within the factory,



Cut No. 1. Exterior view of oil storage house.


1" Reinforcing Rod projecting 4' above top of pipe
Space filled with concrete
Leader point.
Pipe to be driven to hard ground
If ground is very soft additional supports may be needed for floor.

Cut No. 2. Ground plan and foundation of oil storage house.

because of the usually more complete segregation of the hazard, is more of an amelioration than a remedy.

If such structure is located at an ordinarily safe distance the time consumed in transferring the contents as required and the inconvenience in bad weather are obstacles to its adoption, and in the case of substances like some varnishes that require protection from cold, these obstacles are practically prohibitive in many cases.

The desideratum seems to be a type of low cost houses of sufficient fire resisting qualities to permit of their construction immediately adjacent to the factory with a minimum danger.

Such houses must necessarily vary as the contents are to be classed as volatile or non-volatile, they must be vented in such a manner as to be reasonably secure from destruction by "explosion" (*i. e.*, rapid combustion).

The construction for non-volatiles must be such that the contents cannot overflow (the intent being their complete combustion within the house), and the supply of air must be as far as practicable from above the material, in order that the combustion may be as slow as possible and produce smoke rather than flame, which condition in itself means the resolution of the ignited oils into their elements (by fire) at the lowest temperature consistent with the process that can be attained, thus retarding the production of combustible or "explosive" gases.

In the case of volatile oils, however, their retention is undesirable, and some method of permitting them to escape in a safe direction requisite.

But as the vapors of these are generally heavier than air, any scheme of ventilation to secure against their accumulation is inconsistent with any plan for retention of oil.

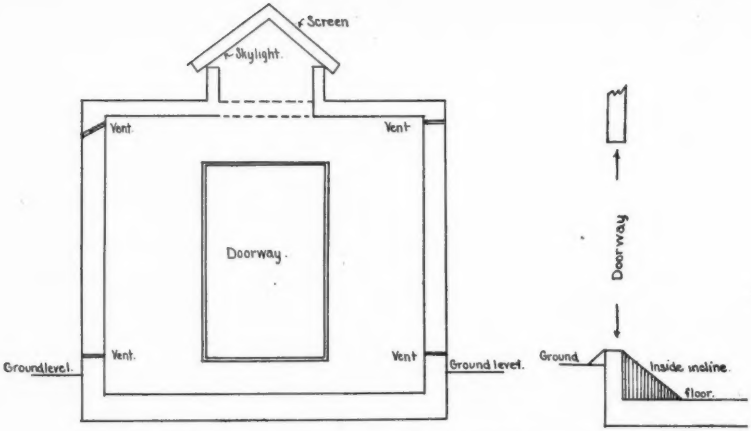
In offering the annexed specifications I have sought to cover these points and to suggest a practically fireproof structure especially suited to the purpose, and at a minimum of cost.

The roof scheme is such that very considerable spans are permissible without members or supports, it being of course understood that other weights than that of the roof itself and such snow as may fall upon it are not provided for, but the size and spacing of the interlacing reinforcing rods will necessarily vary with the span. The roof is a very economical one for reinforced concrete.

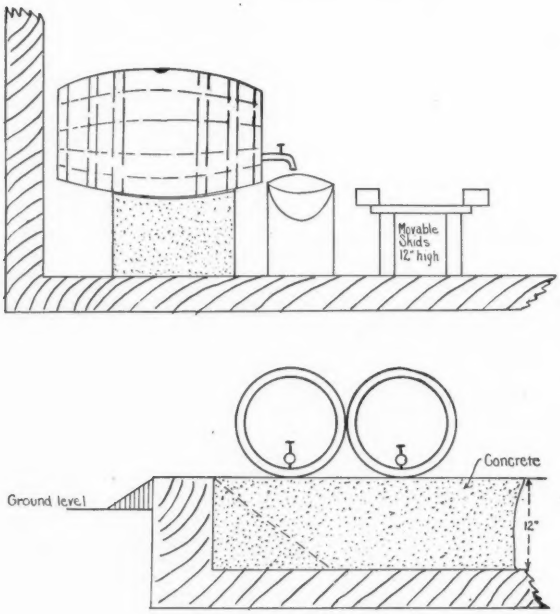
It is impossible to suggest foundation plans for all situations. Generally pier foundations upon which a reinforced concrete sill can be molded cost least, and the retaining pit can be built up against them and waterproofed below ground level.

In the matter of convenience in handling, the plans speak for themselves, the feature being the introduction of barrels on skids on a level with the racks.

The plans and specifications are offered as *a*, not *the* solution, are not untried in substance, and subject to any and all improvements or varia-



Cut No. 3. Sectional view of oil storage house.



Cut No. 4. Arrangement for skidding the full barrels horizontally to permanent racks.

tions that may be suggested, the desire being to offer a practicable suggestion whereby the existing objections to segregating this oil storage and handling hazard may be overcome in many cases.

SPECIFICATIONS.

Oil House for Non-Volatile Oils.—Castor, Linseed, Lubricating, Cutting Turpentine, Grain Alcohol, Etc.

Assumed size 10 x 12 feet and 8 feet high (inside measure).

Capacity about 18 barrels storage. Retaining capacity of depressed floor without overflowing threshold 900 gallons = 18 average barrels.

Walls. Brick or concrete, at least 8 inches thick.

Roof. Concrete slab with interlaced rod reinforcement. Rods dropped to 1 inch above bottom of slab. A central opening about 3 x 4 feet clear, ledged or parapetted on all sides; 12 inches above roof and 4 inches thick with a single rod reinforcement each side.

Skylight. To cover central opening, to be of thin glass on metal sash and frame and screened. Screen to be carried on metal supports, and to be of 14 (American) gauge galvanized wire, one-half inch mesh and 6 inches above glass.

Floor. Concrete, slightly dished and about 8 inches below ground level. This depression and raised threshold are sufficient to prevent overflow in case of fire bursting barrels or tanks and also the height is such that barrels to be tapped for drawing can usually be skidded on a level to racks.

Door. National Standard tin-clad door in rabbetted wrought-iron frame.

Threshold. To be 4 inches above ground level (*i. e.*, distance from top of threshold to top of floor to be 12 inches).

Ventilation. First. A series of 1-inch pipes extending through wall set 2 to 3 feet on centers and just above level of top of threshold. Second. A similar series of 1-inch pipes near eaves and inclining slightly downward toward outside (in no case must the bottom pipes be below level of top of threshold).

Foundations. As may be desired. That shown, which is generally cheap and feasible and especially suited to soft or wet ground, consists in driving 6-inch wrought-iron pipes with "leader" points until hard pan or other satisfactory support is reached (as in sinking driven wells).

Into each pipe is dropped a 1-inch reinforcing rod extending about 4 inches beyond and above upper end of pipe, and space in pipe about rod is filled with rather rich concrete. These can be set as far apart as 10 feet when desired, but 5 to 8 feet is better.

In building upon this foundation the lower course of concrete requires reinforcement of from 3 to 5 rods and would better be a sill molded in position. Where walls are brick they can be built upon this sill.

Roof Exception. When oil house is 50 feet or more distant from any exposing building, roof, if so desired, can be of corrugated iron on pipe or angle frame or truss (no wood whatever to be used in construction).

For Volatile Oils or Compounds containing Naphtha, Wood Alcohol, Etc.

Since the vapors of these are heavier than air and tend to settle and accumulate in depressions, the floor, instead of being depressed, should be elevated above ground and the ventilating pipes as near floor as possible, and the threshold should be flush with floor. In every case where the flow of burning oil could by any means endanger adjacent buildings, the oil house should be entirely surrounded by a ditch or embankment sufficient to retain its entire contents.

In all other respects the same specifications apply to both, but are not to be taken as avoiding the necessity of storing large quantities of naphtha, amyl acetate and similar dangerous materials in buried tanks when and wherever such buried tanks are called for by law or the regulations of the underwriters.

Carriage and Wagon Factories---Fire Record.

Total number of fires, 147.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 2.
Electric light wires short circuited, arc igniting floor joists.
Caused from electric light wires.
HEATING. Number of fires, 9.
Stove heating, 8 fires.
Overheated stove pipe ignited woodwork.
Overheated chimney ignited rafters.
Caused from overheated coal stove.
Sparks from stove caused fire.
Overheated stove in varnish room.
Fire occurred from heating stoves, 3 fires.
Steam heating, 1 fire.
Ignition of combustible material against steam heating pipes.
POWER. Number of fires, 5.
Unknown near electric motor.
Fire originated at electric motor.
Fire caused from overheated friction clutch.
Hot bearings, 2 fires.
BOILER (or fuel). Number of fires, 18.
Overheated woodwork around boiler stack.
Overheated woodwork over boiler furnace.
Heat from boiler stack ignited roof.
Heat from boiler ignited dust and combustible material.
Spark from boiler furnace ignited dust on beam over same, 2 fires.
Ignition of dust on top of boiler, 2 fires.
Pile of shavings used for fuel ignited either from spark or heat from boiler furnace.
Spark from boiler furnace lodged under asbestos sheathing on ceiling.
Sparks from boiler furnace entered attic through open door.
Sparks from smokestack ignited roof of gravity tank.
Sparks from smokestack ignited roof of dry kiln.
Sparks from smokestack ignited roof, 3 fires.
Caused from sparks, 2 fires.

RUBBISH (or sweepings). Number of fires, 2.
Spontaneous combustion in a barrel of rubbish.
Fire started in rubbish which had collected under flooring.
OILY MATERIAL. Number of fires, 5.
Spontaneous combustion of oily waste or material, 4 fires.
Spontaneous combustion in a truck of sweepings caused by a pair of painter's oily overalls.
SMOKING. Number of fires, 4.
Lighted match or cigar thrown on ledge inside of elevator enclosure.
Fire started in a box of sawdust used as a cuspidor.
Carelessness of employees smoking.
Outsiders smoking near building.
LIGHTNING. Number of fires, 3.
LOCOMOTIVE SPARKS. Number of fires, 5.

Special Hazard Causes.

DRY KILN OR ROOM. Number of fires, 2.
Fire caused from stove used for heating dry kiln.
Unknown in redrying room.
SHAVINGS VAULT. Number of fires, 2.
Supposed sparks from boiler furnace in shavings vault.
Unknown in shavings vault.
SHAVINGS BLOWER SYSTEM. Number of fires, 1.
Spark from locomotive drawn into top of cyclone shavings collector.
WOODWORKING MACHINES. Number of fires, 7.
Oil drippings from power carving machine caused spontaneous combustion in a pile of shavings underneath.
Hot journal on woodworking machine.
Probably oily sawdust in saw table.
Oily sawdust at band saw ignited spontaneously.
Spontaneous combustion in oily sawdust under woodworking machine.
Fire originated under shaft box, probably caused from oil-soaked sawdust.
Hot bearing on band saw ignited sawdust.
GLUE POTS. Number of fires, 2.
Overheated glue pot; workman left without shutting off gas burner under glue pot.
Gas furnace for heating glue pots ignited ceiling.
DIP TANKS. Number of fires, 3.
Employee stepped on match near dip tank, igniting contents.
Employee lighted match over asphaltum dip tank.
Dip tank fire.
PAINTING AND VARNISHING. Number of fires, 6.
Fire caused from spontaneous combustion of lampblack.
Spontaneous combustion in a half barrel of lampblack.

Boy held lantern too near the top of a barrel containing five gallons of japan and benzine which he was mixing.

Caused from can of varnish stored in back of heating stove.

Employee ignited upholstery of hack while burning off paint with gasolene torch.

Wheel oiling—spontaneous combustion of sawdust, boiled oil and benzine left in building over night.

JAPANNING. Number of fires, 1.

Japanning house destroyed from explosion of gas in a japanning oven.

FINISHING AND PAINTER'S OILY RAGS. Number of fires, 4.

Spontaneous combustion of oily finishing rags.

Spontaneous combustion of paint or varnish rags.

Spontaneous combustion of painter's oily rags.

Spontaneous combustion of oily rags.

FUEL OIL (Metal heating). Number of fires, 2.

Caused by broken burner at crude oil forge.

One quarter inch fuel oil pipe broke over heating furnace.

FORGING AND FORGES. Number of fires, 10.

Sparks from power hammer ignited combustible material.

Floor joists which were in contact with flue from a large furnace became overheated and ignited.

Stack from forge ignited flooring above.

Defective chimney from forge ignited roof.

Defective chimney from forge.

Coals from forge.

Sparks from forge, 4 fires.

TIRE HEATERS. Number of fires, 2.

Overheating of flue from a large tire-heating furnace in yard. Flue entered chimney through building wall.

Defective chimney from natural gas tire-heating furnace.

MISCELLANEOUS. Number of fires, 4.

Gasolene torch exploded in blacksmith shop.

Watchman's lantern ignited vapors from a half barrel of varnish left in storeroom at end of day.

Automobile being repaired; not thoroughly drained of gasolene, and drippings collected on floor, igniting from unknown cause.

Employee repairing roof set can of roof cement on stove to heat. Cement ignited and fire spread to factory.

Summary.

Common Causes.

	No. of Fires	Per Cent of Whole
Lighting	2	2.0
Heating	9	9.1
Power	5	5.1
Boiler (or fuel)	18	18.2
Rubbish (or sweepings)	2	2.0
Oily material	5	5.1
Smoking	4	4.0
Lightning	3	3.0
Locomotive sparks	5	5.1
Total	53	

Special Hazard Causes.

Dry kiln or room	2	2.0
Shavings vault	2	2.0
Shavings blower system	1	1.0
Woodworking machines	7	7.1
Glue pots	2	2.0
Dip tanks	3	3.0
Painting and varnishing	6	6.1
Japanning	1	1.0
Finishing and painter's oily rags	4	4.0
Fuel oil (metal heating)	2	2.0
Forging and forges	10	10.1
Tire heaters	2	2.0
Miscellaneous	4	4.0
Total	46	
Common Causes	53	54
Special Hazard Causes	46	46
Total	99	
Incendiary	1	
Exposure	3	
Cause Unknown Fires	44	
Total Carriage and Wagon Factories Fires	147	

2. DETAILS OF CAUSES.

Common Causes.

H-1580. The metal pipe from office stove passed through second floor to chimney. Stovepipe became overheated, igniting sheathed ceiling of office, and spreading into finishing room above before arrival of fire department, burned rapidly among the varnished carriages.

H-1813. Fire undoubtedly originated at motor used for power sewing machines in cushion-making department. This was supported on a wooden bracket about six feet above work bench. Linoleum, leather and excelsior were stored under bench, which greatly increased the spread of fire.

S-3428. Sparks from a passing locomotive entered building through a broken window, igniting upholstering material.

S-4335. Sawdust and shavings were used for fuel. These liberated considerable fine dust in boiler room, and beams above boiler were covered with this dust. Sparks from boiler furnace probably lodged in the dust, smouldering and later breaking out into flame.

S-4913. Fire was caused by sparks from boiler stack falling in shavings and dust which had collected on roof.

H-5220. Fire was caused by an overheated stove in varnishing room, fire having been kept up during the night on account of unfinished work, the weather being cold.

S-9594. Factory shut down at 5.30 p. m. Engineer was leaving engine room when he saw flames issuing through a shaft opening about a foot square, lined with wood, located in brick wall between machine shop and elevator room. The flames were from burning grease around a hot box on countershaft in machine shop. Flames ignited the ceiling timbers in the elevator room over shaft opening. One sprinkler opened and extinguished fire at this point.

Special Hazard Causes.

H-273. Fire occurred at about 4.45 p. m., caused by the carelessness of an employee holding a lighted lantern too near the top of a barrel containing a few gallons of japan and benzine which he was mixing, stirring same with a stick.

H-296. Fire was caused by oily sawdust at band saw.

S-776. Workman was burning paint from the outside of hack which was being repaired. A gasolene blow torch was being used, and flame passed through crack in door, setting fire to the upholstery.

H-1213. Fire was caused by the flue from a large tire-heating furnace. Furnace was located outside in yard, but flue passed through side of building to chimney, passing underneath the wooden joists of second floor. These became overheated and ignited.

H-1392. Sparks from locomotive were drawn into top of cyclone shavings collector, igniting shavings which dropped into boiler room.

H-3366. Fire was caused by the overheating of jacket for warming glue pot. This was arranged for either steam or gas heating, at the time of fire gas-heater being in service, and employee left building without shutting off the gas supply. Jacket overheated, igniting a wooden post near by.

S-4349. Fire occurred in the repair department, sixth floor of carriage factory. When bringing automobiles into building, it is customary to disconnect and drain gasolene tank, but in this case the draining was not thoroughly done and drippings collected on floor, igniting in some unknown manner.

S-5393. Fire started on bench which was used for paint mixing, probably caused by spontaneous combustion of oily paint rags.

S-5738. Fire occurred in forge shop, caused by the breaking of a quarter-inch fuel oil pipe over a heating furnace.

S-6507. During afternoon previous to fire employee emptied part of a package of lampblack into paint pot, intending to mix it for painting carriage bodies. Finding he had used too much, he returned some of it to the package, replacing package on shelf. There was probably moisture or oil in paint pot, causing spontaneous heating of the lampblack several hours later.

S-7177. Fire occurred in erecting and wheel shop, caused by fuel oil which gushed from broken burner at forge.

S-9258. Fire occurred in tire-setting room, caused by sparks from forge.

S-9355. Fire was caused by a natural gas heating furnace with a defective chimney. Chimney was of single thickness brick, extending from level of furnace up through attic and roof and was in close proximity to a wooden column. Mortar had loosened and a piece of brick fallen out near the place where flue from furnace entered chimney. This allowed flames and heat to escape, igniting wooden column.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Storage and non-manufacturing	10	21	4	9	8	27	22	18
Boiler room	12	26	1	2	3	10	16	13
Engine and motor room	1	2	..	..	1	3	2	2
Dry kiln or room	..	..	2	5	1	3	3	3
General woodworking	6	13	11	26	8	27	25	21
Shavings vault	..	..	2	5	..	..	2	2
Blower fan room	1	2	..	..	..	..	1	1

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Upholstering and trimming	4	9	1	2	3	10	8	7
Dip tank room	..	..	3	7	..	..	3	3
Painting and varnishing	5	11	7	17	4	13	16	13
Erecting and repairing	1	2	2	5	.	..	3	3
Machine shop	1	2	..	..	..	..	1	1
Smithy	2	4	8	19	2	7	12	10
Roof fires	4	9	1	2	..	..	5	4
Total with data given	47		42		30		119	
No data	6		4		18		28	
Total	53		46		48		147	

4. DAY OR NIGHT FIRES. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Day	24	48	20	43	7	15	51	36
Night	26	52	26	57	39	85	91	64
Total with data given	50		46		46		142	
No data	3		..		2		5	
Total	53		46		48		147	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Plant in operation	20	43	19	43	11	28	50	39
Plant not in operation	26	57	25	57	28	72	79	61
Total with data given	46		44		39		129	
No data	7		2		9		18	
Total	53		46		48		147	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Employee	25	49	22	48	6	13	53	37
Watchman	10	20	14	30	13	29	37	26
Thermostat	2	4	1	2	..	..	3	2
Sprinkler Alarm	3	6	1	2	1	2	5	4
Outsider	11	22	8	17	25	56	44	31
Total with data given	51		46		45		142	
No data	2		..		3		5	
Total	53		46		48		147	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent of Whole
Extinguished or practically extinguished fire	47	63
Held fire in check	23	31
Unsatisfactory	5	6.7
Total	75	
No claim	37	49
Small loss	32	43
Large loss	6	8
Total	75	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

1005. June 7, 1900. Fire was discovered by watchman at 12.30 a. m. in the unsprinklered wooden rim house. Definite cause of fire is unknown, the probable cause being sparks from boiler stacks of sawmill, although stacks were equipped with spark arresters. Mill buildings were of frame construction, badly congested, the unsprinklered buildings severely exposing those equipped with sprinklers; storage buildings were filled with partly finished stock, and there were also piles of kiln dried hardwood lumber piled around these buildings in yard. A strong wind was blowing at the time, and the fire made very rapid headway, working into the sprinklered portions of stock shed, into the sawmill, bending room and boiler room. The sprinkler system in these sections was in service, but

was unable to check the fire which, spreading through these sections, entered other unsprinklered sheds and lumber piles leading to the main buildings.

Sprinklered buildings were equipped with a Grinnell system of sprinklers, metal disc heads, supplied by a 14,000-gallon gravity tank on wooden trestle between main buildings, and a 13,000-gallon gravity tank on wooden trestle fifty feet south of main buildings. The latter tank supplied system through a three and one-half inch connection located only three or four inches below ground, and this was further reduced to two inches where connected to system. Tanks were about nine and ten feet elevation, and supplied two two and one-half inch yard hydrants. System was maintained dry in winter, but water was probably on at time of fire. Two hose streams were used from hydrants during fire. These seriously reduced the water pressure on sprinklers in main buildings, and later the pressure was further reduced by the breaking of sprinkler piping when sawmill and stock shed collapsed.

The fire spreading to the main building entered through the unprotected windows. The sprinklers opened promptly, but with the weakened tank supply and pressure, failed to check the fire, and it is doubtful had tanks been full that sprinklers would have had sufficient supply to hold fire at this point. The system was entirely operative, and noticed discharging water.

The property was outside of the city limits and hydrant protection. Fire department was called by 'phone, but did not respond in time to control fire. All buildings, stock sheds, sawmill, tanks, etc., were totally destroyed, even the brick stack of boiler house collapsing about half way from the top. Loss estimated at approximately $160,000.

Summary: Severe exposure fire from unsprinklered buildings and lumber piles.

2911. January 24, 1904. Fire occurred at 9.38 a. m. in the basement of the east section, used as a boiler room. Cause unknown, but probably sparks from boiler. Building was equipped with "Up-to-Date" sprinklers, dry system, water supplies from pressure and gravity tanks. One hundred and thirteen sprinklers in all opened, but sprinkler system was of little value on account of the defective dry valve.

The first fire occurring shortly before 9.38 a. m., was discovered by watchman, who promptly notified city fire department. Upon arrival of firemen they connected to steamer connection, but no water was pumped, as it was found that the sprinklers were discharging but little water. The fire was apparently extinguished after it had gained some headway on the ceiling construction and on the frame partition separating boiler from engine room. An "Up-to-Date" dry pipe valve controlled the sprinklers in the burned portion. This valve had been tested by an inspector a couple of days before and pronounced as entirely unreliable, at which time it was recommended to the owner that the sprinklers immediately exposed to frost be disconnected, and water placed on system in the basement. This

recommendation was not acted upon by the owner, who claims that he had the valve set up dry at time of fire.

When fire was apparently extinguished and firemen had retired, the owner shut the valve controlling the systems in this section, as there was danger of freezing, the windows having been broken.

The second fire broke out on the first floor over boilers in wagon factory, and communicated to second floor. Sixty-five heads opened on first floor and forty four on second floor. Evidence was found of some water having been discharged from a few of the sprinklers on the first floor.

When fire was discovered, insured tried to open valve shutting off sprinklers, but succeeded in only giving it a couple of turns, the drain valve being left open. Fire department pumped water into system through steamer connection, but owing to the open drain, the partly closed gate valve and the large number of open sprinklers, their efforts in this direction were of little avail. Fire was extinguished by the department. Many fused but unopen sprinklers were found after the fire was extinguished.

Summary: Defective dry-pipe valve. Sprinklers shut off.

3340. June 20, 1904. Building was five stories in height, brick, open joist construction, fire occurring on the fourth and fifth floors, occupied for body finishing and upholstering. The cause of fire is unknown, fire starting on both floors simultaneously. Watchman and outsider discovered fire at about 6.30 p. m., and gave alarm; water being on dry system and dry valve sprinkler alarm out of service.

The building was equipped with Grinnell glass disc sprinklers, installed in 1902, 1-2-4 pipe sizes, spacing nine by eight feet. Sprinklers were on two dry systems, wet at time of fire, supplied by water works giving about twenty pounds pressure on sprinklers opened. Secondary supply was from an 8,000-gallon gravity tank, fifteen feet elevation above highest sprinklers. There was no serious obstruction to distribution to sprinkler discharge. One hundred and seventy-two sprinklers in all opened. The reason for the opening of so many sprinklers is not known. There was evidence of very little or no water being discharged by sprinklers until sometime after start of fire, as joists immediately above sprinklers were badly charred in many places. This, however, may have been due to the rapidity with which fire spread through the fourth and fifth floors, opening an excessive number of sprinklers, on account of deficient or light water supplies. Loss about $10,000.

Summary: Deficient water supplies. Fire spread rapidly, opening 172 heads.

4908. September 9, 1906. Fire started in the unsprinklered paint room of a neighboring carriage factory, exposing this building across a twenty-foot alley. Sprinklered building was three stories in height, brick, semi-mill construction, equipped with Manufacturers' sprinklers, installed in 1906. Spacing and arrangement of sprinklers was of modern design, on wet system, supplied by two pressure tanks of 4,500 gallons capacity each and a gravity tank of 20,000 gallons. The fire in the exposing plant

destroyed the gravity tank before many heads opened, leaving the two pressure tanks as the only source of supply at the time building was ignited. The water supply was further seriously depleted at a critical time by watchman who knocked open several sprinklers before fire had actually attacked building. The amount of water in these tanks was entirely inadequate to check the fire, and the office section was practically a total loss, while the factory section was damaged by water and fire around windows.

Sprinkler system was equipped with a steamer connection, but fire department failed to connect to same. Loss, $38,900.

Summary: Exposure fire.

9593. March 6, 1910. Buildings were mainly of large area, frame construction, one high story and occupied for woodworking, painting, blacksmithing, storage, etc. Interior protection consisted of a fair supply of pails of water and sand, watchman with approved portable watch and an old standard sprinkler equipment, with only one water supply from city mains, which was very deficient in volume, but of fair pressure. Pressure is not raised on alarm of fire and volume is capable of supplying about ten heads.

The system covered the greater portion of the property, but unsprinklered parts adjoined and seriously exposed sprinklered portions because of the construction. The obstruction to sprinkler distribution from stock on racks in woodshop and storage building was moderate. The dry valve was heavily overloaded, supplying a total of 678 heads; there were 302 heads in one fire division.

The outside protection consisted of three private hydrants, provided with hose houses, hose and equipment; also volunteer fire department and assistance in the way of hose and equipment from adjacent mills.

Cause of fire is unknown, the only theory advanced being spontaneous combustion of rubbing-rags or waste used in upholstering and painting department. Watchman discovered fire after his 11.30 p. m. round and gave the alarm to the central telephone station. About twenty or thirty minutes elapsed before arrival of the fire department, which is volunteer, with one-horse hose wagon, located about one mile distant.

Soon after discovery of fire the floor of the building collapsed, breaking a five-inch sprinkler main supplying sprinklers in west storage building, which put the sprinklers out of commission and reduced the ordinarily deficient city supply to such an extent that it was practically of no value. The sprinklers were then shut off and efforts were made to protect the surrounding property. Hydrants were unavailable, as the wind was blowing in this direction and fire was fought with hydrants of adjacent property. The main building was protected by a bucket brigade on roof and at windows.

The waterworks supply to sprinklers was very deficient, and could not be counted upon to control a fire opening more than ten heads. The outside protection was also deficient, only one efficient stream being

available. Fire spread rapidly on account of construction and occupancy of the building. Loss, approximately $50,000.

Summary: Deficient water supply.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control is satisfactory.)

2715. January 18, 1904. Fire occurred about 1.30 a. m. in the five-story unsprinklered frame building, exposing the sprinklered carriage factory building, completely destroying frame building, and proving a severe exposure to sprinklered building. The exposure consisted of a five-story wooden building about forty by eighty feet, with a four-story wing of the same dimensions, extending to within about forty feet of sprinklered building. There was also a one-story brick boiler house at the end of this wing, which was only about ten feet distant from boiler house located at side of sprinklered building.

The end of exposure nearest sprinklered building had a blank brick wall. This collapsed during fire, falling onto boiler house of sprinklered building, wrecking roof, and filling house with debris.

Sprinklered building was of frame construction, five stories in height, and equipped with a system of Grinnell glass disc sprinklers, pipe sizes standard, wet system, supplied by waterworks, thirty-seven pounds pressure on top floor. In connection with the inside sprinklers there was also a partial system of Grinnell open sprinklers, extending about eighty feet along side of building adjacent to exposure. Open sprinklers were Grinnell "shovel" pattern, installed about 1898, spaced one over each vertical row of windows, or about nine and a half feet apart. Good pipe sizes. Windows under open sprinkler protection were also further protected by wooden shutters. Shutters were closed during fire, and with the open sprinklers, prevented fire from entering sprinklered building at this point. The brick chimney of exposure fell against building, breaking in one vertical row of windows, but causing no fire damage.

Fire ignited outside of sprinklered building just beyond the shutter, and open sprinklers entering building on each floor through windows, opening sprinklers as follows: fourteen on fifth floor, eight on fourth, four on third, one on second and first. These sprinklers, with the aid of fire pails and hose streams, prevented fire from gaining a foothold inside of building, although side of building was burned out for a space of from fifteen to twenty feet on all floors. With exception of this wall and damage to boiler house there was very little damage by fire, although water damage was considerable. It was necessary to shut off entire sprinkler system on account of the freezing weather and demolished boiler house. Night and day watchman service was instituted, covering period sprinkler system was out of service, by order of the Chief of Police.

The exposing building was completely destroyed. Had the wooden shutters and open sprinklers extended full length of sprinklered building there would probably have been no fire loss to the building. Loss, $12,300.

Summary: Exposure fire.

5669. September 9, 1906. Fire occurred between 2 and 3 p. m., Sunday, when plant was not in operation. Watchman discovered fire, and gave alarm. Section in which fire started was of frame construction, iron clad and iron lined, occupied for storage of coal on first floor; cushion making with excelsior stuffing on second floor. This section was not equipped with sprinklers, in fact only about one-third of plant was under sprinkler protection. The sprinklered sections were equipped with Neracher sprinklers, 1-2-4 pipe sizes, wet system, supplied by pressure tank, giving ninety pounds pressure; secondary supply from gravity tank.

Cause of fire is not definitely known, but was probably due to spontaneous combustion in the soft coal, fire spreading through the cushion and excelsior stuffing department to the painting department.

Twenty-seven sprinklers opened in adjacent sections, and with the help of fire doors confined fire to the section in which it originated. Although fire doors were not standard, they withstood fire well and materially aided the checking of fire. Loss, principally in the unequipped sections, totalled $143,616.

Summary: Unsprinklered sections.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

H-177. Watchman discovered a smouldering fire and immediately gave alarm.

H-296. Fire gained considerable headway through failure of watchman to give alarm before attempting to fight fire. He nearly succeeded in extinguishing same, but it finally got away when nearby fire pails and chemical extinguishers had been exhausted.

S-437. The sprinkler alarm failed to operate on account of being improperly connected to the water supply, the water not passing through alarm valve. Sprinklers were in operation when discovered by employee in the morning.

H-1000. Fire was discovered at 2.45 a. m. by watchman, in adjacent building, who immediately gave public alarm. Just prior to discovery of fire, watchman of building had passed through this section, not noting any signs of fire.

S-3428. Sprinkler alarm failed to give notification of fire, due to defective batteries.

S-3903. Outsiders discovered fire and called to watchman who blew whistle and then rang in the public alarm box at factory, watchman failing to discover fire. Watchman carried a Buerk watch with fifteen stations. The recording dial, which was on clock the night of fire, contained the records of Saturday night, Sunday and Sunday night, and was so perforated that it was impossible to tell whether watchman made complete rounds on the night of fire, a station being located ten feet from where fire started.

S-4335. Building was equipped with American ether tube thermostats, connected to fire department station and bell in engineer's house. Thermostats operated immediately, giving alarm of fire. There was no watchman service.

S-5104. Fire was discovered by watchman, sprinkler alarm having been disconnected.

H-8393. The alarm service of plant was poor. There was no watchman or alarm on dry valve of sprinkler system. An electric connection had been installed on swing check valve, which was supposed to operate an electric bell on building, but this failed owing to corroded bell. Fire occurred sometime during the night, being extinguished by three sprinklers which were in operation until factory was opened in the morning.

Automatic Sprinklers.

S-87. Fire started in unequipped blacksmith shop in yard, adjoining and communicating with main sprinklered building. Eighteen sprinklers opened in main building which, together with two hose streams, prevented fire from entering the building.

S-437. Five sprinklers opened and practically extinguished the fire. Two of the sprinklers became clogged shortly after opening with cinders and pieces of hemp that had gotten into the underground piping during laying of pipes.

S-4349. Gasolene fire. Two sprinklers opened and held fire in check, but burning gasolene floated around on water, being finally extinguished by fire department with hand.chemical extinguishers.

S-4914. Fire was caused by employee lighting a match over an asphaltum dip tank. Thirty-two sprinklers opened supplied by city water under approximately sixty pounds pressure, holding fire in check. Later on the water pressure was increased to about eighty pounds by using fire pumps.

S-5821. The sprinklered building was severely exposed by the burning of the unsprinklered dry kiln which was ignited by the burning of japanning house. Forty sprinklers in all opened, holding fire in check and preventing it from gaining a foothold in building.

Construction.

S-2600. Boiler room ceiling was partly brick arch and partly frame construction covered with asbestos sheathing. This sheathing was not tightly fastened in place and the fine wood dust from shavings collector, located in open bin in boiler room, had collected under sheathing and was easily ignited by sparks from boiler furnace. This exposed the outside frame constructed wall of dry room, also spreading into the dry room floor, which was completely burned out.

S-3248. When forge was installed it was connected with an old wall flue formerly used as duct from hot air blower system for heating building.

The masonry had not been properly built around floor beam when building was erected, thus exposing the beam to the direct flame from the forge. Forge was used about ten hours previous to fire, fire smouldering in beam, finally burning through wall and igniting the paper sheathing with which ceiling had been covered in this part of the room. One sprinkler was opened by the blaze holding fire in check.

Fire Doors.

H-4281. The fire spread so rapidly that employees were forced to run for their lives. The metal-clad doors at end of covered passageways connecting buildings No. 3 and 4 were open and only one could be closed, allowing fire to spread over the entire manufacturing portion of the plant, which was completely destroyed. Loss approximately $250,000.

Floor Openings.

H-1332. Building was five stories in height, brick, heavy open joist construction, elevator shaft enclosed in frame work. Fire occurred in basement, spreading through a twelve by twelve inch ventilating shaft to all floors. All floors were charred in the vicinity of the shaft. The greatest damage resulted on the fourth floor, where several freshly varnished vehicles were ignited. Fire did not spread into elevator shaft.

H-1520. Fire was general throughout building upon discovery. Building was three stories and part basement in height, plank and beam construction, with a large unprotected well hole in center used as an elevator shaft, stairs also were not cut off. The fire probably started in basement, rapidly spreading to upper floors through the unprotected well hole and stairway, burning through roof and causing practically a total loss to building.

H-3204. No information could be obtained regarding origin of fire. It apparently started in trimming room on second floor, rapidly spreading to third floor through open elevator shaft nearby.

Obstruction to Distribution.

S-659. Fire occurred in the carriage trimming shop, fourth floor, starting in a closed carriage body. Three sprinklers opened and confined fire to body although they could not reach seat of fire. Engineer heard sprinkler alarm and completed extinguishment of fire with pails of water. The sprinklers so effectually checked the fire that the outside finish on the carriage was only slightly damaged while the interior was completely burned out.

S-1147. Fire started in a lower compartment of rack used for storing wagon wheel stock. The covering over compartment obstructed water from sprinklers and fire spread into a joist channel receiving poor sprinkler protection, spreading and entering a covered belt box on third floor. This

belt box was not equipped with sprinklers. Sprinklers operated and confined fire to belt box so that when fire department arrived there was only a smoldering fire, which was quickly extinguished.

S-8509. Fire occurred in frame re-drying room on third floor. Seven sprinklers opened and extinguished fire with the assistance of two hand chemical extinguishers. Sprinklers were severely obstructed in operation, dry room having two slatted decks below sprinklers, room also being full of stock at time of fire.

Private Protection.

H-273. The alarm of fire was promptly given and employees, under command of foreman, quickly attached hose to nearest standpipe. The hose was not long enough to reach fire and by the time fire department arrived the main building was on fire throughout, fire spreading with great rapidity and violence.

H-5160. Employees responded at once to alarm of fire, using standpipe hose streams and chemical extinguisher, confining fire to a very small area. Fire department responded but was not needed.

Public Protection.

H-2487. The hydrant nearest to plant was frozen at time of fire, causing total loss of building. Loss approximately $22,000.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	22	47	3	13	..	25	33	1	25	33
2	10	21	3	13	..	13	17	2 or less	38	51
3	6	13	2	9	..	8	11	3 or less	46	61
4	2	4	2	9	..	4	5	4 or less	50	67
5	2	4	1	4	..	3	4	5 or less	53	71
6 to 9 inc.	2	4	3	13	..	5	7	Less than 10	58	77
10 to 24 inc.	1	2	4	17	..	5	7	Less than 25	63	84
25 to 49 inc.	2	4	5	22	..	7	9	Less than 50	70	93
50 and over	..	..	..	..	5	5	7	50 and over	5	7
Total	47		23		5	75				

Average number of sprinklers opened, not including unsatisfactory, 6.3.

12. ALARM SERVICE.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	19	95	1	5	20
Sprinkler alarm alone	4	67	2	33	6
Thermostat alone	2	100	..	..	2

	Watchman.		Sprinkler Alarm.		Thermostat.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm	7	1*	8	..	..	..	8
Sprinkler Alarm and Thermostats	..	..	1	..	1	..	1

* These include fires where sprinkler alarm or thermostats notified the watchman.

Note.—These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

13. SECONDARY WATER SUPPLIES.

3125. Primary water supply was from waterworks giving 60 pounds pressure. Seventeen sprinklers opened and fire pumps were started increasing pressure to 120 pounds.

4908. Primary water supply, two pressure tanks. Secondary water supply a 20,000-gallon gravity tank. Exposure fire destroyed gravity tank and pressure tanks were not of sufficient capacity to hold fire in check.

5669. Primary supply, pressure tank at 90 pounds pressure. Secondary supply from gravity tank. Twenty-seven sprinklers opened and secondary supply was of much value.

5689. Primary supply, waterworks at 45 pounds pressure. Secondary supply from fire pump. Dip tank fire opened 41 sprinklers and fire pump was efficiently used on sprinkler system and hose streams.

14. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Waterworks,	49	66	51	7.1	59	37	4	55	47	38	3.6	12.9
Gravity tank,	5	7	25	6.8	60	40	..	24	28	..	2.6	12.0
Pressure tank,	12	16	92	4.5	75	8	17	90	90	100	2.0	27.0
Automatic pump,	8	11	79	5.7	75	25	..	78	83	..	6.2	4.5
Total,	74		59	6.6	64	31	5	63	50	69	3.6	12.8

15. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	..	..	..	..	..	..	..	..	..	..	..	..
15 to 24 inclusive,	7	9	20	3.7	43	57	..	20	20	..	3.0	4.2
25 to 49 inclusive,	21	28	39	9.3	52	38	10	39	38	37	7.1	12.4
50 and over,	46	62	75	5.9	72	24	4	75	70	100	2.5	16.3
Total,	74		59	6.6	64	31	5	63	50	69	3.6	12.8

16. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS.

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened	
					Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	43	58	60	5.9	53	42	5	67	50	65	1.7	11.2
Dry system,	31	42	59	7.7	77	16	6	59	52	73	5.4	18.6
Total,	74		59	6.6	64	31	5	63	50	69	3.6	12.8

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.

Primary Water Supply.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Waterworks,	49	66	51	7.1	43	51	6	58	47	37	4.0	9.1	28.0
Gravity tank,	5	7	25	6.8	60	40	..	24	28	..	2.7	13.0	..
Pressure tank,	12	16	92	4.5	42	42	17	99	85	90	1.4	2.2	27.0
Automatic pump,	8	11	79	5.7	100	..	..	79	..	..	5.8	..	..
Total,	74		59	6.6	50	43	7	66	52	58	3 9	8.5	27.5

18. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	..	..	..	..	..	..	..	..	..	..	..	..	..
15 to 24 inclusive,	7	9	20	3.7	28	72	..	26	20	..	3.0	4.0	..
25 to 49 inclusive,	21	28	39	9.3	33	52	14	42	37	40	2.9	11.6	28.0
50 and over,	46	62	75	5.9	61	35	4	75	72	90	4.1	6.8	27.0
Total,	74		59	6.6	50	43	7	66	52	58	3.9	8.5	27.5

19. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS. —As Regards Amount of Loss

Wet or Dry System.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	43	58	60	5.9	51	40	9	65	51	64	4.0	5.8	27.5
Dry system,	31	42	59	7.7	48	48	3	66	53	35	3.8	11.8	..
Total,	74		59	6.6	50	43	7	66	52	58	3.9	8.5	27.5

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

Unsatisfactory or Serious Fires in Buildings Equipped with Sprinklers.

Where sprinklers fail the cause is, almost invariably, clear. These fires are selected to indicate such causes, that they may be generally understood and satisfactorily met.

10253. February 17, 1910. Metal Worker. Fire occurred at 5.30 p. m. while plant was in operation, in the lacquer room in second story of Building B, a basement, three story and attic brick building, of open joist construction, except in lacquer room and a few small rooms sheathed with wood. A stairway extended from basement to top floor which was enclosed on each floor with a seven-eighths inch wooden enclosure with wooden floors. This was located about the center of side, close to the east wall. The elevator at the south end of building was equipped with automatic traps. With the exception of a few belt holes there were no other openings. Building was occupied as follows,—basement, grinding stove parts, smith shop and storage of raw stock; first floor, stove mounting department; second, lock department, lacquering and drying, assembling and finishing, also storage of lock parts; third, stove mounting; fourth or attic, storage of finished stoves.

Building was completely equipped with a system of Grinnell glass disc sprinklers, 1-2-3 schedule of pipe sizes; spacing, two lines in fourteen foot bays, lines being eight feet apart, heads seven to eight feet apart, staggered spacing in first, second and third floors. There was no obstruction to distribution. System was equipped with a six-inch Grinnell differential dry valve which supplied 619 sprinklers. This dry valve operated satisfactorily after water was turned on system.

The lacquer room was ten by twenty-one feet, three sides formed by wooden, part glass partition, the fourth by east wall of building. Ceiling was sheathed with wood. Room contained three dip tanks, two with a capacity of about six and one-third gallons each, the third holding about four and one-third gallons. Tanks were of metal with metal covers not automatic. Tanks were kept about half full of lacquer when in use, the supply being brought in as needed in cans from the main oil room located in a separate building. The fire occurred in this lacquer room near the west end. It is stated by the two employees who were working in the room at the time that they saw a spark drop from near the ceiling to one of

the dip tanks. They seemed to think it was from the electric lighting system. The dip tank ignited, immediately spreading to the two other dip tanks in room, the rapidity of combustion appearing in the nature of an explosion, shattering the window at the east end of the room. The lacquer in cans in room does not appear to have ignited. Fire rapidly spread over the wooden partition and ceiling, burning through the partition on each side, also through the ceiling for a distance of eight feet along west side of room.

Fire also appears to have spread to north of room for about twenty feet, and to the south for a short distance beyond the stairway. It also spread across room to west about twenty-five feet. The indications are that fire followed line of stairway quite rapidly, spreading into third story by this means, and thence into fourth or attic.

The fire doors at openings into Building "A" in second story were closed as soon as employees were judged to be out, the doors in attic and third closing automatically.

Alarm was transmitted to fire department by means of manual fire alarm box to the messenger and signal company's central station. Fire station is across street from building, and some of the firemen, having noticed smoke at building, were leaving in charge of assistant chief when alarm came in. This was about 5.35 p. m.

Several hose streams were laid by the fire department; of these, three were laid into east side of building, and one played into lacquer room where fire was seen to be heaviest. About five minutes later, or at 5.40, the chief of department arrived at building and took charge. In about twenty minutes or so it was deemed safe to enter building. It was found that there was little fire left except about the stairway enclosure which was on fire in a few places.

No attempt was made, so far as can be learned, by the employees in building to extinguish fire. The burning lacquer generated an intense heat with accompanying smoke which drove the employees from rooms. Two men who delayed were overcome and suffocated.

The sprinkler system was shut off at the time fire started. A few days before owner had noticed there was a considerable amount of water seeping into building from the yard, and on digging up the ground in yard, found there was a leak in the underground piping supplying sprinkler and hydrant system. It was decided to make the necessary repairs, and water was shut off entire system the morning of fire. The men were nearly through, and intended to turn on water at 6 p. m. for the night. When the fire alarm was given, it is stated the engineer first shut off the power in the building and then, with the machinist, hurried out to the valve at east end of yard, and let water into the yard and sprinkler system, which probably took five minutes to do. The chief who arrived about five minutes after fire alarm was sent in, states that the sprinklers were discharging water at that time. Sprinklers were in operation for about twenty minutes, when the chief, considering the fire was under control,

requested that the water be shut off as it would facilitate firemen entering the building. They did so, and found the fire practically out, as noted above.

All of the sprinkler heads in the second floor, 127, including several in small enclosures for offices, etc., were opened, except three sprinklers in the outside passage to plating building. Some 60 sprinklers in the third floor were opened, which with two exceptions were in the northerly part of room, this floor being divided by a partition across room from east to west, about 60 feet from south end. Three sprinklers in the northwest corner were not opened. With the exception of nine sprinklers, all the heads (141) in the attic were opened. Of these nine sprinklers not opened, two were under a small inclined runway near the floor, and the other seven in a portion of roof lower than the balance. One sprinkler opened near stairway in first story. In all, 324 sprinklers out of a total of 503 opened in these four floors.

There appears to have been a very fair supply of water for part of the sprinklers, as water markings on ceiling and beams in third floor are quite distinct. There was, however, no water thrown from sprinklers in attic, as in a number of cases the glass discs which close the nozzle outlet were still in position, although they could be lifted out by hand. Owner states that when they opened the fire doors in second and third floors to ascertain progress of fire, they found the sprinklers discharging strongly. The sprinkler opened in first floor was fused when firemen opened stair door momentarily in early part of fire, evidently before water was turned into system.

There appears to be no one who knows what the pressure was on these sprinklers (193) in operation. The fire chief reported good pressure for fire streams, but the amount discharged by the opened heads was apparently too great to permit of any water being available on the attic floor. The fire pump was not used. The fire in attic did not seem to have gained sufficient headway to continue, although the roof boards were quite heavily scorched.

The sprinkler system was shut off at time of fire, and not turned on for about five minutes. In this time the fire gained a great headway; but it appears that when the water was turned on system, there was a perceptible check to the fire in the burning parts in second and third floors, and the opened heads in the unburned parts seem to have wet down the ceilings, preventing further spread of fire. It would appear that had the building been without sprinklers, there would have been an almost total loss.

The light stairway enclosure, together with the fact that doors to same were undoubtedly open at time of fire, is accountable for the rapid spread of fire into third and attic floors.

The damage to the building was moderate. While a number of the joists immediately over the point where fire started were rather badly burned, and the wooden ceiling destroyed, the other joists do not appear

seriously injured. The partitions around lacquer room and the stairway enclosures and stairways were badly damaged. The floor boards where sheathing was destroyed were burned about three-quarters inch deep for a small area. The damage in third floor to building was slight, and it is doubtful if any of the joists here were seriously weakened. A portion of the wearing floor in third floor will probably require replacing. The roof was badly scorched over a considerable space.

The principal loss was to the stock of lock and stove parts which were stored in rooms, third floor and below. They have suffered rather heavily from water. There were also a number of belts and such articles destroyed, and the electric lighting system in a considerable portion of second floor was ruined.

There was no damage to the adjoining or nearby buildings, although some water ran into basement of Building "A" adjoining, which will probably cause a loss on stock stored therein. Machinery in various rooms was somewhat damaged. Loss, $10,218.

Owners have decided to remove lacquer dipping tank rooms from main building, building a fire resistive structure between this building and adjacent one. The stair enclosures are to be put in good condition, with automatic doors at floor openings.

Summary: Water shut off sprinklers at time of fire on account of repairs.

9775. April 29, 1910. Woolen Mill. Fire occurred from unknown cause at 12.45 a. m. while plant was not in operation, evidently starting in the north end of second floor of the main mill building occupied for carding and spinning, Building was of plank and timber construction, frame walls, joist roof. The second floor was constructed of five-inch planks on timber, the third floor of three-inch plank on timber. Occupancy of building was as follows: First floor, looms and finishing department; second floor, the north half where fire started was occupied for carding, the south half for mule spinning. The third floor was occupied by stock bins, stock being blown direct from picker house to bins, and for mule spinning.

The watchman was in room where fire started about fifteen minutes before fire was discovered by outsider, detecting no signs of fire. Outsider gave alarm by shouting, watchman then blowing mill whistle. No cause for the fire could be found. Incendiarism was rumored, but no proof substantiating this theory could be developed.

Building was equipped with Esty No. 5 sprinklers, installed in 1904; wet system, 1-2-3 schedule of pipe sizes, sprinkler heads spaced eight feet across by eight feet with joists and nine feet across by nine feet with ceiling pockets. There was apparently no obstruction to distribution. The primary water supply was from gravity tank giving a pressure of from seventeen to twenty-three pounds with tank full. Secondary supply was from steam pump which was of great value in controlling fire.

The engineer upon arrival immediately attempted to start the fire pump, but as steam pressure in boiler was low, only about twenty pounds, it was necessary to fire boilers with wood, oils, etc., before pump could be started. This caused a serious delay. At the time engineer arrived the whole north section of the two upper floors of mill were in flames, the fire spreading with great rapidity through these floors, aided by the strong wind which was blowing at the time. After a short while steam pressure was raised and fire pump started. From this time on the volunteer fire department fought fire intelligently, practically confining fire to the two upper floors. The post indicator gate valve controlling gravity tank supply was closed when pump was started, as the engineer did not wish to rely upon the check valve, and the pump was then run at full speed. Not long after the hose streams from fire pump were brought into service the roof collapsed, breaking the five-inch riser on second floor supplying sprinkler system, and the post indicator gate valve controlling this building was then shut and the full discharge of pump used on the hose streams. The fire lasted about three hours, being finally extinguished by hose streams.

After fire the sprinklers in fire area were all found open, but from reports and appearance of ruins they had little or no effect in checking fire. Engineer states that post indicator gate valves were open and tank full, but firemen using hose streams state that no water was discharged until after fire pump was started. Nothing has developed to prove or disclaim this assertion, and fire to all appearances burned as if there was no water discharging from sprinklers until after pump was started. A total of between 130 and 140 sprinklers in all opened.

The building was a total loss above the first story, the remainder of plant being but little damaged.

Summary: Gravity tank empty at time of fire.

10072. July 16, 1910. Oilcloth Factory. The building in which fire originated consisted of a three-story brick drying building, 100 by 49 feet, with a one-story brick printing building, 60 by 84 feet, adjoining and communicating with drying building on the north side. Buildings were of joist construction, with single floors, board roof covered with slag, elevator and stairway in three-story section not enclosed. The three-story building was occupied for drying floor oilcloth, which was printed in the one-story section adjoining; each floor contained four drying racks, the three floors being capable of holding about 600 pieces of oilcloth. Drying racks were constructed with wooden uprights, but with iron cross rods and end pieces, so that there was but little combustible material in racks other than the oilcloth in process of drying. Racks were nine feet wide, twelve feet high and about seventy-five feet long.

These dry rooms were closed, with heat turned on at time of fire. There was a very severe thunder storm, and about 8.30 outsiders saw lightning strike building, watchman and fireman at building not knowing of fire until hearing the sprinkler alarm bells ringing. Watchman then

pulled two Gamewell auxiliary alarm boxes at plant, but the lightning had crippled the system, causing the alarms to be given incorrectly. Alarm was given to fire department by 'phone by an outsider.

Drying building was equipped with International 280 degree sprinklers, on 1-2-3 schedule of pipe sizes, installed in 1906. Sprinklers and piping were so arranged that there was a line over each rack, a line over aisles between racks, also aisle sprinklers at sides of racks. Spacing of heads was from five to six feet with joists, by six to seven and one-half feet across joists, staggered spacing. There were 144 sprinklers in room, 105 opening. Primary water supply to sprinklers was from a 30,000-gallon gravity tank, second supply from fire pump. The obstruction to distribution was considerable from the oilcloth drying in racks.

The fire pump started automatically upon operation of sprinkler system, pressure later being raised to 100 pounds by opening the throttle. The fire department quickly reached building, bringing four engines, and hose streams were soon in service, extinguishing fire after from two to three hours' fighting. The damage by fire was confined to the roof and tops of a few racks near the place where lightning struck building. The balance of the roof was not charred, owing to the sprinkler protection. Most of the damage to oilcloth was from water which collected in the hollows or troughs in the cloth formed by the supporting cross bars of racks.

As nearly as could be learned, fire pump was in service about four hours supplying hose streams and sprinkler system. Small pumps were kept in operation pumping into the 150,000-gallon reservoir from which the pump took suction, the small pumps draughting from wells. There must have been an intense heat under roof during fire, as nearly all of the 280 degree sprinklers inside of dry room were opened. As noted, there were also aisle sprinklers along the sides of racks, staggered vertically, supplied by separate risers with outside control, each head being protected from water discharged above by a cone-shaped metal cover. Of these aisle sprinklers, only two opened, these being directly under the points where roof was burned the most. Sprinklers prevented fire from spreading over roof or to floors below. Loss approximately $5,000.

Summary: Severe hazard with obstruction to distribution.

10314. July 29, 1910. Woodworker. Factory consisted of two two-story brick, joist constructed, mill buildings, equipped with sprinklers and occupied for the manufacture of sash, door and interior trim; two frame lumber sheds, two stories high, and one one-story miscellaneous storage shed, said to have contained baled shavings and some old lumber at time of fire. Fire started at about 8.15 p. m. from unknown cause, either in this storage shed located at the extreme west end of premises or in the large two-story lumber shed about fifteen feet distant and extending into center of premises 140 feet, running parallel to the brick mill buildings at a distance of about fifteen feet. Wind was blowing from the southwest at the time of fire.

Fire was discovered by an outsider who gave alarm through the public fire alarm box one block distant. There was no watchman.

The sprinklers in the brick buildings were Grinnell glass disc, installed in 1909; modern spacing and arrangement under open joist construction. Sprinklers were mainly on wet system except the dry system in glaze shop and office, etc.; these were on a Grinnell straightway dry valve. Primary water supply to sprinklers was from water works 50 to 55 pounds pressure.

Upon arrival of fire department the large two-story lumber shed was well ablaze and the fire was threatening or had already entered the brick mill buildings fifteen feet east of it. The fire engines were attached to a six-inch dead end main, from which the six-inch connection for sprinkler system was taken, thus depriving sprinkler equipment of an adequate water supply. However, some of the sprinklers were noted throwing water. The fire rapidly spread through the several closely situated buildings, through unprotected windows. The brick cut off wall with single tin-clad door in center of the brick mill building had no effect in stopping the fire. Loss was practically total with the exception of brick walls of mill buildings.

Fire shows the critical value of protection against portions of premises not equipped with automatic sprinklers, also the need of proper cut offs and secondary water supply. Loss approximately $75,000.

Summary: Exposure fire. Unsprinklered buildings severely exposed those equipped with sprinklers.

10311. August 2, 1910. Carpet Mill. Fire was caused by a Lorimer stock dryer at 6.55 a. m. while plant was in operation. The cause of fire is unknown, but it is known that it started in the dryer which was used for drying all stock used in mill. Dryer was located on the first floor of building No. 2, which was thirty-five feet by one hundred and twelve feet in area, a wing to building No. 1. Building No. 2 was constructed with stone and brick walls, plank floors, open mill ceilings, and was occupied for washing and drying wool, yarn and jute. This building was only partially equipped with automatic sprinklers, the first and second floors being unequipped, and only a partial system in third and fourth floors. Sprinklers were largely Grinnell lever type heads on wet system, supplied by waterworks and a 1,000-gallon Underwriters steam fire pump. Water pressure on top line of sprinklers was about seventy pounds.

The mill begins work at 6 50 a. m. fire being discovered about five minutes later by an employee who was preparing to start the dryer. This man was working around dryer when he was startled by a sudden burst of flame from the steam coil enclosure of dryer, which seriously burned him. He immediately pulled private fire alarm.

The dryer was built by the Lorimer Cyclone Dryer Company of Philadelphia. It was of wooden construction throughout, and drys the stock by air which is heated by being drawn through steam coils by a blower. Engineer states that new steam coils had been installed a few months before fire, and that machine had been thoroughly cleaned at that time. The

fire probably originated from rubbish or woodwork coming in contact with the steam coils or piping, gaining great headway, feeding on the interior of the dryer before breaking out. The dryer had not been started nor had it been in service since the day before. Fire did not burn through the ceiling of the room in which the dryer was located, but spread through the windows into the adjoining dye house section, through roof and through a covered bridge and boxed cornice into the upper stories of building No. 2. These upper floors were equipped with sprinklers, as noted above, and although they did not control fire they undoubtedly checked what otherwise might have been a total loss, the most serious fire damage being noticeable where there were no sprinklers. About one-third of the east end of top floor was not equipped, fire entering building at this point.

The fire pump was started immediately so that pressure was probably well maintained. The fire wall between buildings No. 1 and 2 checked spread of fire in that direction, although heat passing through unprotected openings in the first floor of building No. 1 opened two heads. Sprinklers in equipped portions operated satisfactorily, but fire was beyond control of sprinklers as installed by the time it reached them. Loss approximately $30,000.

Summary: Unequipped portions.

10278. August 9, 1910. Woodworker. This building was damaged during the conflagration which started in an adjoining lumber yard. Sections No. 1 and No. 2, which were destroyed, were basement and four stories high, brick, open joist construction, occupied mostly for woodworking.

Sprinklers were Grinnell type "D" metal seat, Walworth ordinary upright and Hill upright. These were on wet system, old standard pipe sizes, spacing ten by ten feet under open joists. There was considerable obstruction to distribution from lumber, partitions, etc. System was supplied by waterworks twenty pounds pressure on top line.

By the time fire reached this block it was of conflagration size and of too great magnitude for sprinkler control. Sprinklers found in ruins were open and engineer states water was on system. The fire wall between sections No. 2 and No. 3 was effective in stopping the spread of fire in that direction, no sprinklers opening in section No. 3. Loss large.

Summary: Conflagration.

10312. August 24, 1910. Grain Elevator. Fire started from unknown cause in the upper portion of elevator, watchman discovering same at 3.30 a. m., noticing flames in the cupola at the top of the marine leg on the river side. An alarm was turned in at once, but the fire being under great headway when discovered spread rapidly, the firemen experiencing great difficulty in getting their steamers to the fire and placing them where they could do effective work. Watchman claims to have made round at 2 a. m. and was due again at 4 a. m.

The building was of frame iron-clad construction, equipped with Grinnell glass disc sprinklers, old schedule pipe sizes, dry system, controlled by three Grinnell differential dry valves; primary water supply from a 1,000 gallon automatic steam pump, secondary water supply from an eight-inch city connection at fifty pounds pressure. The sprinklers did not seem to operate at first. This was undoubtedly due to deficient pressure from automatic steam fire pump, as there was probably but light steam pressure on boilers. Soon after fire department arrived pressure was put on sprinkler system and the sprinklers deluged the building, checking fire so that fire department was able to cope with it. The sprinklers would probably have extinguished fire in its incipiency had the proper pressure been maintained by the automatic fire pump. Loss $200,000.

Summary: Deficient water supply and pressure.

10310. August 26, 1910. Planing, Saw and Shingle Mill. Plant consisted of ordinary joist constructed saw and shingle mill and boiler house, planing mill, shingle mill, lumber and shingle drying kilns. These buildings were built on piling over refuse filling, partly tide-washed. Plant was badly congested with elevated platforms connecting saw and shingle mill with the planing mill and two dry kilns. There were no bulkheadings under the platforms or wharf.

The fire occurred at 11.10 p. m. from unknown cause, the planing mill only being in operation. Employees state that they first saw fire near the junction of the two mill sprinkler systems in the center of the second floor of sawmill, and that it spread so rapidly that after having pulled whistle cord they were forced to leave the building.

Watchman made a round through sawmill at 11 o'clock, but did not discover fire or notice any odor of fire. Fire alarm was given from about half a mile distant, the department arriving in about twenty minutes, being delayed by the inaccessibility of the property.

Buildings were equipped with Niagara-Hibbard type "B" 1906 sprinklers, installed in 1907. Pipe sizes were 1-2-3 schedule, good spacing and arrangement of sprinklers. Dry system controlled by a Grinnell differential dry valve under an air pressure of 60 pounds and supplying about 300 heads. The primary water supply to sprinklers was from waterworks at 166 pounds pressure, secondary supply from another waterworks supply independent of the primary supply. Both supplies were in service until fire was under control.

The fire spread rapidly over the dust accumulation on woodwork, opening a large number of heads before water could reach sprinklers, nearly 300 of which were opened. This was possibly due to the slow action of the dry-pipe valve under the excessive air pressure. An examination of the sprinkler valves and piping after the fire showed that the gate valves were fully open and that system was in operation during fire. Fire was fought by fire department, private hose and sprinklers. The entire plant was completely destroyed. Loss $200,000.

The result of the fire showed the need of the following improvements in plants of this nature: Curtain boards on cutting floor of sawmill; bulkheadings in basement of mill and under wharf between buildings, also independent supplies for sprinklers and hydrants.

Summary: Large dry system slow in operation.

10286. September 11, 1910. Harness Trimmings, Saddle and Brush Factory. Property as a whole consisted of a nest of old buildings exposing one another through unprotected doorways or across narrow alleys. Building No. 4 in which fire started was of brick, part joist and part plank and timber construction, first floor divided into two rooms by a brick wall with unprotected openings. One room was used for celluloid converting, *i. e.*, the dissolving of celluloid with solvents, the other for storage of scrap celluloid, finished sheet celluloid, alcohol, amyl acetate, etc. The ceiling of convertor room was of open plank and timber, the ceiling of storage room being sheathed wih wood, asbestos covered. Second floor was occupied as a machine shop and third by celluloid dissolving department and screw stuffing machines.

Building No. 4 severely exposed building No. 5, on the northwest, which was formerly used for dwellings and of particularly poor construction—hollow wooden lath and plaster walls, ceilings and partitions, occupied for storage purposes; building No. 3, on the southeast, leather building, occupied for buffing and polishing, harness and brush department, also stairway between building No. 4 and brush department. Good single automatic tin-clad fire doors cut off direct openings between buildings No. 4 and No. 5 and openings between building No. 4 and frame stairway between building No. 4 and brush department of building No. 3. These were apparently blocked open at time of fire, the links fusing but doors not being able to close on account of obstructions. There were also unprotected angle window openings in building No. 4 to No. 5 and building No. 4 to No. 3.

These buildings were fully equipped with automatic sprinklers installed in 1908. Sprinklers were Manufacturers issue "C" upright, on wet system with the exception of a small dry system in building No. 5. The pipe sizes, spacing and arrangement of sprinklers were in accordance with the present practice. Water supplies were as follows: a six-inch connection from a twenty-inch high pressure main giving a static pressure of 150 pounds, two gravity tanks of 17,000 and 9,000 gallons capacity, twenty-five and twenty feet above sprinklers, and two steamer connections.

Fire occurred from unknown cause in the storage room, first floor of building No. 4, at 2 p. m. Sunday, while plant was not in operation. The cause of fire could not be definitely ascertained. It is possible that the men who were in the machine shop were smoking, it being stated that men had been noticed smoking when working on Sunday, and a match or smoking material may have been tossed down the unprotected elevator floor opening, igniting loose inflammable material at bottom of shaft. The blaze rapidly

spread through the unprotected floor openings to the combustible material in the storeroom, to the machine shop, and to the especially hazardous third floor, where large quantities of dissolved celluloid were stored.

As far as is known, there were five employees and the day watchman around buildings at the time of fire. Four of these were repairing an automobile, working in the fire-resistive building and alley adjoining on the north; but just previous to fire two employees carried some parts of the automobile into the machine shop on second floor of building No. 4 for repairs. While in machine shop they heard a dull thud or explosion, and glancing up, saw flames coming up an unprotected elevator floor opening. They immediately jumped into the yard, escaping without injury. The floors through which elevator passed were equipped with traps, which were carried up by the elevator as it raised and deposited as it descended. Elevator was at top floor, and all openings unprotected at the time of fire.

The fifth man at the factory was the one in charge of the sprinkler system. He had been repairing a post indicator gate valve on building No. 4, which necessitated the closing of all post indicator gate valves on the sprinkler equipment. He was positive that all valves were open and equipment in working order at 11 a. m. and the conditions of the ceilings of buildings in the fire area would tend to substantiate this statement. At the time of fire he was near the engine room door, first floor of building No. 3, leather department, charging some chemical extinguishers. He also heard a dull thud, and upon looking up saw flames, the door in the division wall of No. 3 rear being open, and immediately ran to a Gamewell auxiliary alarm box on the fourth floor of the new fire-resistive building. He claims to have properly turned in an alarm, but according to the records of the central station headquarters, alarm from this box was not received by them. This employee passed the regular fire alarm box on the second floor, in going to the auxiliary alarm on the fourth. The fire alarm company state that these wires were put out of commission by the fire in building No. 4.

The property was divided by the alley between buildings No. 1 and No. 3 into two watchman's routes. On Sundays the watchman takes the No. 1 building group the first hour, then the No. 3-4-5 buildings group the second hour, then the No. 1 group, etc.; *i. e.*, bi-hourly rounds for each group. The group of buildings in which the fire occurred had been visited on the 12 o'clock round, and nothing unusual noted. At the time of fire the watchman had finished his rounds in No. 1 building group, and had started on his 2 o'clock round of the buildings in the fire group. He had punched one station, according to records and his statement, when he heard an outcry of fire, and followed the man referred to above to the auxiliary fire alarm on the fourth floor of the new fire-resistive building. Watchman's records for the time preceding the fire are in every way satisfactory.

The first alarm to be received by the fire alarm office was by telephone from the reserve stables of fire department near property at 2.03 p. m. Box No. 5 was also pulled at this time; box No. 51 at 2.04; box 354 at

2.04; box 36 at 2.04; box 53 at 2.05. Notice from the repair shop of fire department to send out a second alarm was received by telephone at 2.05. Notice for third alarm from box No. 5 was received at 2.07. Twelve fire engines and other apparatus, including water tower, responded to the above alarms, and nineteen streams were played upon the fire. Ten of these streams were fire engine streams and nine were streams from the high-pressure hydrants in the immediate vicinity. It is said that the fire lasted from an hour and a half to two hours, but the last engine did not report to headquarters until about 6.30.

Probably all the sprinklers in building No. 4, in which fire started, were opened within a very short time, the heat being intense and spreading fire rapidly. From the top floor of No. 4 fire spread to buildings No. 3 and No. 5, opening sprinklers in rapid succession. All sprinklers in buildings No. 4 and No. 5, and practically all in building No. 3, a total of 524, out of 568, were opened. Five sprinklers were also opened in the fire-resistive building by the heat.

As to the sprinklers, a four-inch connection from a six-inch yard main had to supply 129 sprinklers in building No. 4 through three, two and a half and two-inch risers on the second and third floors respectively, in addition to some 68 sprinklers in building No. 5, which were connected to this four-inch riser by a four-inch branch line with a Manufacturers 1907 dry valve. Air pressure on the system was about 30 pounds at the time of fire. Valve apparently operated satisfactorily. The static pressure at the time of the fire was about 150 pounds on the first floor. The waterworks gauge at the City Hall, which is at a higher level, registered 130 pounds, and showed a drop of about fifteen pounds between two and three o'clock, the hours of the fire. It does not appear that any portions of the piping were wrecked by an explosion. Considerable of the piping is down or bent out of position on the top floors, but the risers are intact. Where heat was apparently most intense several melted sprinklers were found. These were on the third floor of building No. 4 particularly, also third floor of buffing and polishing department of building No. 3. The gravity tank above building No. 4, which was poorly located, considering the hazardous nature of the building, was damaged by the fire. The roof was burned off, and it was otherwise damaged. It was said to have been found empty, and it is also said that water was noticed running out of the staves at the time of the fire. The gravity tank on the fire-resistive building was also found empty after the fire.

This fire resistive building was equipped with wired glass windows on the side towards the fire and sustained practically no damage, although enough heat apparently passed through to open five sprinklers on different floors.

Although sprinklers in building No. 4 were unable to check fire in its incipiency, they were probably of great value in preventing the total destruction of the plant. These sprinklers were severely handicapped by the hazardous occupancy, floor openings and the small risers which supplied them, as given above. The poor construction, lack of standard cut-offs,

non-isolation of hazards and open fire doors were all conducive to unsatisfactory sprinkler control and rapid spread of fire.

The wired glass windows in non-standard metal frames in the unsprinklered building opposite the windows in building No. 3 were cracked in the upper stories, but successfully resisted the spread of fire. Fire shutters on the south wall, top floor of building No. 4, were closed and prevented the spread of fire in that direction. Loss estimated at $200,000.

Summary: Severe hazard; unprotected floor openings.

10313. September 22, 1910. Metal Worker. Fire occurred at 6.20 p. m. from unknown cause in the ordinary joist, frame constructed, iron-clad wheel house. The main plant was not in operation, but the portion of plant occupied as an electric power house was running. Considerable trouble had been experienced from hot bearings in this wheel house, and fire undoubtedly started from this cause. Fire was discovered and alarm telephoned by night attendant, who also acted as night watchman, fire starting before he commenced the night rounds.

The plant was only partially equipped with automatic sprinklers. Wheel house is said to have been equipped with four sprinkler heads, but there were large unsprinklered areas immediately adjoining. Areas in main building were fairly well covered by a system of Manufacturers pendent sprinklers. These were supplied by a gravity tank giving from 60 to 100 pounds pressure. Secondary supply was from pump service, but this could not be used as pump was inaccessible after start of fire. There were about 300 heads in the main building supplied by a four-inch riser.

Upon discovery of fire watchman gave alarm to employees living nearby who responded promptly and entering through the power plant used two chemical extinguishers on fire, and thinking they had checked fire from spreading into the engine room went back to get hose. Considerable time was lost in finding and connecting same, the fire in the meantime rapidly spreading through the unsprinklered buildings, then through the entire plant. The volunteer fire departments from two neighboring towns responded promptly and checked fire, it having obtained too great headway to be extinguished.

Practically all sprinkler heads opened and held fire in check in the sprinklered portions until tank fell, breaking the main riser, sprinklers failing to at once control fire on account of the large unsprinklered areas.

The entire plant was destroyed with the exception of foundry, office, boiler and engine house and part of stock room adjoining engine house. Loss large.

Snmmary: Unsprinklered portions.

Fire-Resistive Buildings---Fire Record.

These fires are selected to illustrate the behavior of various forms of fire-resistive construction under exposure to fire from within or without.

H-5365. March 18, 1910. Tenant Manufacturing. Building was ten stories and basement, about 127 feet in height, and about 2,016 square feet in area. The east wall was independent, twenty-four to twenty inches in thickness; west wall party, twenty to twelve inches in thickness, with cast-iron columns and steel wall-beams built into same. The fronts or ends were of stone first, second and third floors; brick above, with stone trim. Walls were parapetted on all sides and adjoining buildings were much lower. Partitions in building were three-inch composition plaster blocks around toilets; office partitions were of wood. Roof, composition on flat concrete arch, with metal cornice; skylights were constructed of thin glass and metal, located in roof over stairs and elevators. Floors were constructed of flat concrete arches, on metal lath with angle iron for supports, between steel beams and girders, beams and girders being protected by metal lath on flanges of beams and wire lath and plaster on web and flanges of girders. Ceilings were formed by plastering onto metal lath of arch. Floor openings were as follows: Stairway was open from basement to first floor, otherwise of iron with slate treads and landings, enclosed in a shaft built of three-inch composition plaster blocks set in an angle or channel iron framework; door openings were protected by stamped metal-covered doors hung in stamped metal-covered trim, also sidelights were of wired glass set in stamped metal-covered sash and frames. There were two elevator shafts constructed of three-inch composition plaster blocks, set in iron framework, with stamped metal-covered doors with wired glass panels to floor.

The entire building was occupied for light manufacturing, such as manufacture of hats, cloaks, suits, etc. Building was heated by steam from boiler located in basement, lighted by gas and electricity, power being derived from electric motors. Fire protection consisted of a four-inch standpipe with fifty feet of two and a half-inch hose on each floor above first. This was equipped with a siamese steamer connection at street level for fire department use.

Fire started about 2.30 in the afternoon, being first discovered in the toilet room near the stairway on the west side of third floor near the rear of building. The cause of fire is not definitely known, but was apparently

due to a lighted match or cigarette thrown down in the toilet room. The first alarm was received by fire department at about 2.30, the second alarm following a short while after.

The fire starting near the stairway and the door into the stair shaft being open, prevented the escape of employees by stair shaft. All chances of reaching the fire escape or elevators were cut off, as fire was located in that section. Occupants were rescued through front windows, one girl being seriously injured by jumping from a third floor front window. A number of others were more or less injured during their excitement in trying to escape.

The fire was confined to the floor in which it originated. It burned away a frame office partition, charred and destroyed the wooden trim around windows, also shelving, fixtures and stock. The structure of the building was not materially damaged beyond the falling of some plaster from the ceiling and side walls. The window sashes and frames were completely destroyed on the third floor, and most of the glass was broken on the fourth floor. The only damage to the outside of the building was the spalling and chipping of the limestone cornice at third floor.

The importance of adequate fire escapes was clearly shown at this fire. A fire escape on the front of the building would have furnished a safe and easy exit and probably have avoided loss of life or injury. The stairway in this building was exceptionally narrow between the first and second floors. If the fire had been of a more serious nature a large loss of life as well as property might have resulted.

H-5598. July 11, 1910. Manufacturing Lard Compound. This was a new six-story building of reinforced concrete construction, occupied for the manufacture of lard compound from cotton-seed oil. There was no fire damage in this building, the slight damage to exterior being caused by the burning of the abattoir plant 79 feet distant. This severe exposure caused a trivial damage to exterior, breaking windows, burning off paint, etc. There was, however, a heavy water damage to contents of building. This was caused by the hot water from the burning abattoir being conducted to the storage basement by an inclined runway. Basement contained a large cold storage plant, where the lard compound, stearine and caustic soda were stored.

Two fire engines, draughting from a large reservoir on the premises, flooded the burning abattoir. An inclined runway extending from the building into the basement of concrete building, collected this hot, greasy water, conducting it into the storage room, where it flooded the basement, negatived the cold storage, raising the temperature to eighty or ninety degrees for many hours, and filling the basement with steam, damaged its entire contents.

S-10225. September 5, 1910. Manufacturing Motion Picture Films. Fire occurred from unknown cause at 10.10 a. m., in the fire-resistive stock house of motion picture factory. Stock house was one story high, fifteen by thirty feet in area and divided into two fire sections. Walls

were twelve inches thick, six inches of terra cotta with six inches of reinforced concrete on the outside. Roof was constructed of book tile, three inches thick by twelve by twenty-four inches in area, supported on exposed steel angle iron and trusses and covered with asbestos shingles. There was a roof lantern of similar construction with galvanized iron louvres screened on the inside with one-quarter inch mesh wire screening. Floors were concrete. Each section had a wired glass window in metal frame in the east wall, the west wall containing a door opening for each section closed with a calamine door, there also being a small wired glass window in metal frame above each door. In the north and south walls were two small louvred screened openings near the floor. Sections were well ventilated.

Surrounding the stock house at a distance of seven feet was an eleven foot high six-inch concrete wall with one opening in the west wall closed with a calamine door.

North section of stock house and court between house and wall was occupied for the storage and handling of inflammable negative films, blank non-inflammable films, barrels of scrap and film clippings; south section for the storage of non-inflammable films in individual metal boxes in closed cases.

At the time of fire a Frenchman, who had been with the concern for some time, was supposed to have been working in the northeast corner of the yard sorting or packing "washed" film in a barrel or box. "Washed" film is the old obsolete films from which the pictures have been removed and which is sold to celluloid manufacturers.

In the north section of stock house another employee was at work unpacking a box of non-inflammable films which had just been received. It is said that two boxes had already been unpacked, and that he was at work on the third at the time fire occurred. The south vault was locked and the court was filled with inflammable and non-inflammable films packed loose and in rolls in barrels and boxes. Just what caused the fire could not be ascertained. Smoking was not allowed in the building nor about the yard but the men were allowed to carry matches for their after-lunch smokes outside of the premises. The Frenchman may have accidentally pulled a match from his pocket and stepped on it, or he may have grown careless with the material in sorting and tested a piece with a match. It does not seem possible that fire could have been caused from spontaneous combustion, or that sparks from the nearby smokestack could have ignited the material, as wind was blowing in an easterly direction, the roof of court also being screened with one-half inch mesh screening.

Fire was revealed by a heavy explosion, followed by several lighter ones. Factory whistles were immediately blown, giving fire alarm. The two employees working in building and court were unable to escape. From the position of the bodies and condition of floor, it is evident that fire started near the outside man who was overcome by the fumes or flames, and that the inside man, in trying to save him, was also overcome.

Both men were found in the northeast corner, between stock house and wall.

The fire rapidly spread over the course taken by employee, entering the north vault through the open door. Fire did not enter the south vault as the door was closed, and although the wired glass window at the top showed signs of intense heat, it successfully held fire from entering. The wired glass window at top of door to north section was melted out of its frame.

Private fire brigade, with brigades of neighboring factories, played hose streams on the frame building at the east side, successfully preventing its destruction, the fire in and around the stock house being extinguished in about fifteen minutes. Hose streams were used from public hydrants, standpipe connections and private hydrants. Private hydrants and standpipe were supplied by a gravity tank giving about twenty-five pounds pressure and waterworks connection, normally closed, but said to have been open at time of fire.

The contents of the north vault, together with stock stored in yard, were all destroyed, although there will probably be some salvage from the non-inflammable films in yard. The wired glass window in the east wall of north vault was melted out of the lower sash as was the wired glass window over door opening. The calamine door was bulged and the wood core charred. Fire department broke hole through roof and the intense heat damaged the plaster on the walls, the building otherwise appearing in good condition.

The wired glass window in the south vault held intact, although the lower sash in east wall was apparently struck by a hose stream. The calamine door was bulged and charred but held in place, and stock was but slightly damaged. Damage to stock house approximately $1,000. While the non-inflammable films do not burn readily, they smoulder and are made worthless by a fire of any magnitude.

Three sprinklers opened in the frame building on the east, which with help of private brigade held fire in check. The roof, however, was badly damaged, necessitating replacing.

The inflammable films should be stored in a separate storehouse and their use discontinued as soon as possible. When inflammable films are returned they should be disposed of at once.

Storehouse for inflammable films should be arranged for the immediate escape of employees in case of fire. In this instance it would have been necessary for employees to travel nearly fifty feet through the seven-foot court around building to doorway in wall on opposite side, had they been able.

Miscellaneous Fires.

Interesting fires are given under this heading without regard to their classification.

H-4457. Fibreloid Comb Factory. Building was of brick construction, three stories and basement high, with gravelled roof; of about 3,000 square feet of floor area and having ordinary light joisted floors. Stairways of iron, one flight basement to first and first to second and two flights second to third floors, all open; also wooden stairway from private office on first floor to second floor in wooden enclosure; also iron ladder stairs from third floor to roof. Hoistway, basement to third floor, not enclosed, trapped by hand traps. Open belt hole first to second floor. Walls and ceilings open finished, except ceilings in part metal. Unprotected communication on first floor. Exposure mild.

Building was occupied for the manufacture of combs from fibreloid which is a pyroxylin compound similar to celluloid. No mounting or decorating was done on the premises.

Occupancy was as follows: Basement, low pressure boiler, gas engine, exhaust pipe passing through floors and roof, protected from woodwork; first floor, office and wagon room, storage of manufactured stock; second floor, nine rough polishing and buffing wheels, three finishing buffing wheels, four boring machines, dipping of combs in acetic acid; third floor, four power and seven-foot machines for cutting combs, steam warming tables of iron, all benches covered with metal. Fibreloid stored in two tin-lined wooden boxes; stated that one day's supply of this raw stock bought at a time, never exceeding 300 pounds. Scrap fibreloid stored in tin-lined wooden box and removed once each week. Rear building contains eight stalls, used as a private stable by manufacturer.

The plant was lighted by open gas jets and heated by steam from low pressure boiler in basement.

It was stated that two cases, each containing about 200 pounds of fibreloid, were occasionally bought at one time. Two hundred to 400 pounds of fibreloid in tin-lined wooden boxes probably constituted the raw stock ordinarily kept on hand. It was stated that 200 pounds of fibreloid is sufficient to make about fifteen gross of combs. The amount of finished stock on hand before the fire is uncertain.

Fire started on first floor in a case of fibreloid combs while being prepared for shipment by two boys. There are two theories regarding the

cause: either the boys were smoking and dropped a lighted cigarette or cigar in the case, or they had finished packing the case and were nailing down the cover when fire occurred from friction or a spark from nails.

The case of fibreloid in which the fire started was located on the first floor near an open hoistway; fire evidently spread rapidly, being fed chiefly by the fibreloid about the plant, aided by the unprotected floor openings. There was delay in sending in an alarm, apparently due to excitement, the first alarm being turned in at the street box by an outsider at 9.26 a. m. When the fire department arrived the fire was general throughout the building. Within an hour from the time fire started it was under control. The high pressure system was in service about one hour and thirty minutes. Fire fought by city fire department only.

The contents of the factory other than machinery and fixtures were practically destroyed. The loss to the building was partial; about one fourth of the roof was burned away, otherwise the roof and all floors were in position, although badly charred in places. There appeared to be no damage to the stable or its contents.

Nine persons lost their lives in this fire, while five were injured and removed to hospitals, where one of them has since died. The newspapers have commented on the lack of exits, or rather the presence of bars blockading them. It is true that iron bars were placed at the only window opening in the first story at the rear of building, and likewise at the six window openings in second story at the rear, except the window directly at the top of the rear stairs, which had the bars partially removed, leaving a space twenty-one inches in width for the full height of the window. It was stated that these bars were removed previous to the fire. Only one of the seven windows at the rear of the third story had bars. It is likely that the fire on the first story deterred most of the persons on the second floor from descending by the open stairway at the rear. In fact it seems probable that the fire and smoke, passing up this open stairway, prevented access to the only unbarred window directly at the head of the stairs, thus causing the occupants to clamber around the barred window most remote from the fire. Recommendations are suggested as follows:—

1. Exits should not be placed where they may be directly exposed by fire and smoke passing through unprotected floor openings.

2. The manufacture of goods from material containing pyroxylin compounds to be confined to isolated localities, not exposing other property. The storage of such raw and finished stock not to be exposed by the factory. No stock to be inside factory except that which is in process of manufacture.

3. Factory and warehouse to be of fireproof construction and equipped with automatic sprinklers supplied by water under high pressure, not less than 75 pounds on highest line of sprinklers.

4. All floor openings to be effectively protected.

5. Smoking in any part of such plants, not only to be prohibited, but such prohibition to be rigidly enforced.

6. Scraps of fibreloid, celluloid and similar pyroxylin compound to be put only in standard metal waste cans and removed daily; such scrap to be kept free from other waste.

7. All dust from pyroxylin compounds to be exhausted by blower to metal box in yard outside of factory.

8. To use only steam heat and incandescent electric light properly guarded.

9. No direct fire heat to be used for warming pyroxylin compounds; hot water only to be used.

10. All dipping or cementing solutions, or materials therefor, not in actual use, to be kept outside the factory.

11. Covers on boxes containing pyroxylin compounds to be secured by screws or an equivalent precaution taken to prevent the possibility of ignition by sparks from nails.

H-4470. Pyroxylin Plastic Combs and Novelty Factory. Fire occurred about 11 a. m. in premises employing nine hands in the manufacture of ivory and tortoise shell goods; also novelties made of materials containing nitro-cellulose (pyroxylin) compounds, such as celluloid and pyralin. The concern occupied about one third of sixth story at front of building. The mechanical equipment consisted of three turning lathes, four buffing lathes, one band saw, four electric motors and one gas stove. It is claimed that two sheets of celluloid were the most kept on the premises. Combs and other articles made of pyralin were also handled. Two cases containing novelties made from pyralin had recently been received. One case had been opened and the contents placed upon a table preparatory to the finishing process. The other case was opened and located near the table, but not unpacked. Premises separated by a thin glass and wooden partition from balance of loft occupied for manufacturing of shirts. The exit from the novelty factory premises was through a fire door leading from the office into the stairway enclosure.

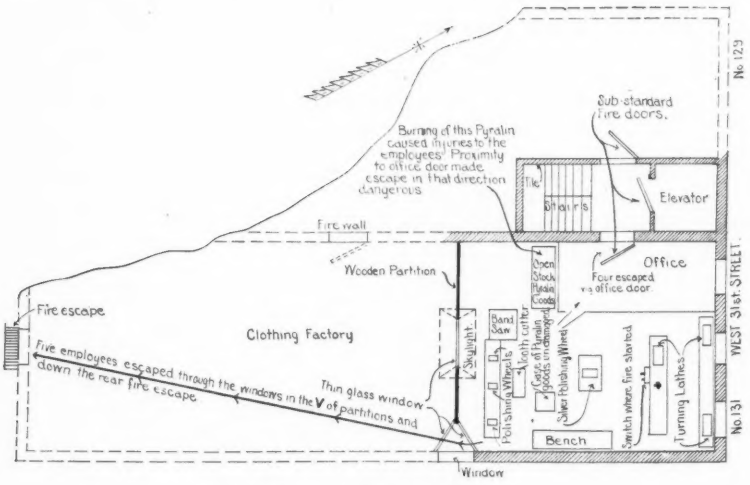
Buildings were two six story and basement, ordinary joisted constructed, brick buildings, with floor area of about 2,000 square feet each. Buildings communicate on all floors through stair shaft, enclosed in hollow tile, and also directly through fire wall on fifth and sixth floors; substandard tin-clad fire doors. Unprotected communication in basement through vault under sidewalk. Ceilings finished with composition board sheathing.

Fire was caused by a spark from the switch used in connection with an electric motor for driving a lathe ignited some pyralin or other inflammable material. This lathe was used occasionally for turning articles made of pyralin. The switch was located below and almost under the lathe.

The fire, which is said to have started simultaneously with the opening of the switch, was fought for a few seconds by several employees. When seemingly under control it unexpectedly spread and ignited the open stock of pyralin novelties on the table, about twelve feet away. Almost instantly the entire contents of the table burned fiercely. The thin glass at once fell

out of the partition and the fire spread to the adjoining shirt factory. The alarm seems to have been turned in with reasonable promptness and the city fire department, upon arrival, soon had the fire under control, practically confining it to the premises in which it started. The open stock of pyralin goods was consumed so quickly that a case of similar goods nearby, not unpacked, did not ignite.

Practically all the employees were more or less burned by the fire and four of them died as the result of their injuries. The burning of the open stock of pyralin goods, taken in connection with the small area of the room, is responsible for the fact that everyone on the premises was directly exposed to the sudden fire and were instantly burned. Most of the employees are said to have escaped through the windows in the "V"



Miscellaneous Fire No. H-4470.

shaped portion of the partition designed to admit light from the outside window into the premises on each side of the partition. Those escaping in this way passed through the shirt factory and descended by the fire escape at the rear wall of the building. Four persons, including those already in the office, escaped in that direction and descended by the main stairway.

The contents of the premises where fire originated were considerably damaged by fire and water. Elsewhere the loss was small and chiefly confined to water damage.

Briefly stated, this fire has demonstrated the importance of isolating establishments using or storing material containing nitro-cellulose (pyroxylin) compounds and the necessity of providing proper safeguards.

H-4722. Cold Storage Plant. Building was a seven story and basement brick structure, occupied by a cold storage and market company for general cold storage purposes. Floors were carried on three by twelve inch joists resting on brick walls, wooden girders and iron and wooden posts. Floors were four inches thick, built up of one-inch dressed boards and felt paper for insulating purposes. All floors above the first were divided by wood and felt paper insulating partitions. That portion of floor over boilers and ice machine department was of ordinary brick arch construction, sheathed underneath with wood. Roof was tin on one inch board on wooden rafters. Area approximately 16,000 square feet. Boilers and refrigerating machinery located in separate fireproof room (not cut off) on the first floor.

The fire was caused by an explosion in an oil receiver connected to a refrigerating machine of the compression type. The wrecked machine (capacity 100 tons) was one of three used in the plant and had been out of service for several days for re-adjustment. At the time of fire a test of the condenser was being made with air pressure, the oil tank (supposedly containing no oil) being in the circuit. Several of the employees were around the machine during the test, one of them being near the gauge, and it is stated that when the pressure reached 200 pounds the oil tank exploded, shattering the upper portion, and some of the men present state that the explosion and flames of fire were simultaneous. The fire continued to burn from the bottom of the tank for a short time and ignited the wood-finished ceiling and other nearby woodwork. The short duration of the flame from the tank indicates that it contained very little oil. The fragments from the ruptured tank broke an ammonia pipe connected to another ice machine, and the fumes from this machine made it difficult for the firemen to enter the room for some time. The floor over the room containing the machines being of brick arch construction prevented the fire from extending through the building. The room in which the ice machines were located was lighted by incandescent electric lights, and it was suggested that the breaking of one of the lamps might have caused the ignition of oil vapor. The oil used, termed "Liquid Base," a petroleum product treated to resist congealation at a very low temperature, is of high burning test (about 400 degrees F.), and it is doubtful if the remaining portion of a heated filament of a broken incandescent electric lamp would ignite the vapor from such an oil. When the machine is in operation under ordinary working conditions, a pressure of from 270 to 300 pounds is reached and at the time of the accident there was no indication of extraordinary resistance. It is, therefore, fair to presume that the rupture of the tank did not result from excessive pressure.

The compressed and, therefore, heated air (it was stated by one of those present at the time of the explosion that a one and one-quarter inch pipe in the circuit became very hot), delivered into the tank at an unknown temperature without doubt converted the small quantity of oil contained in the tank into vapor which, with the air, formed an explosive mixture. The point of ignition of the air-oil vapor mixture under pressure could

readily have been reached by action of the air compression, thereby causing an internal combustion explosion in the oil receiver. The fire damage to building and machinery is reported as slight, and no loss is reported on contents.

The member sending Mr. McDevitt's report on the fire states that he has submitted the conclusions drawn to Mr. Clarence Hall, Expert in charge of the Explosive section of the United States Geological Survey. Mr. Hall gave the report his careful consideration, and although no experiments were made by him, his conclusions were that Mr. McDevitt's statements as to the cause of the explosion seemed to be the most likely explanation.

Mr. Hall makes the recommendation that instead of testing out refrigerating machines with air, carbon-dioxide be used as a substitute for air. It was found in recent tests made at the Pittsburg Testing Station that an eight per cent fire damp mixture containing twelve per cent of carbon-dioxide was rendered non-explosive, Permission has been extended by the Director of the Geological Survey to refer to Mr. Hall's statement, qualifying the statement that no experiment had been made, and that Mr. Hall's opinion is based only on Mr. McDevitt's statements in the report.

S-9469. Motion Picture Film Plant. The building in which the fire occurred was three story and basement, of light construction, brick walls, joisted floors and roof, inside finish largely plaster on wooden lath, and subdivided by three curtain walls, the central wall having sheet metal doors at all openings on either side of wall except in the attic. The building was, however, all exposed to one fire, as the cut offs were only nominal.

It was occupied throughout for the printing, developing and examining of films for motion picture machines and the assembling and repairing of motion picture machines.

The hazards were not excessive and received excellent care. All films except those in progress were stored in a well constructed fireproof storehouse well detached, and the finished goods to be shipped were stored in an entirely detached building which was not a part of the risk, it being controlled by the sales department and at least fifty feet distant.

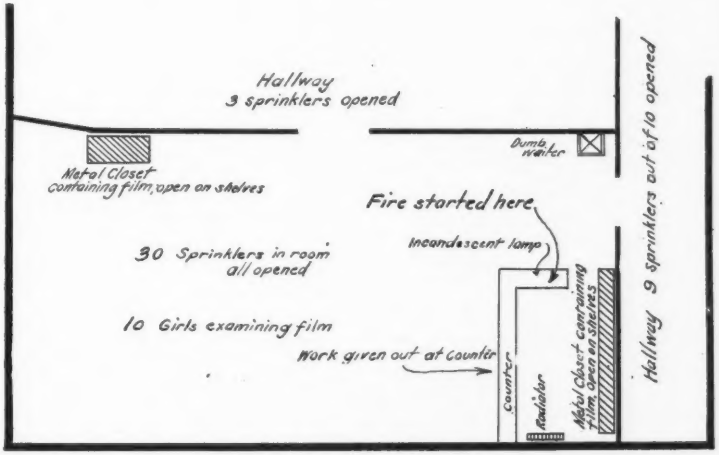
It was stated that about eighty-two per cent of the films handled are of the new so-called "non-inflammable" kind.

The building in which the fire occurred was under the protection of a wet-pipe sprinkler system installed in 1907 and later, fully up to the present standards and supplied by a twenty thousand gallon gravity tank located about twenty feet above the highest sprinklers, about twenty pounds pressure on the sprinklers that operated.

The room in which the fire occurred was about 65 by 30 feet, lath and plaster finish. There were windows on two sides and swinging wooden doors on the other sides giving plenty of vent. The heat was steam; lights, incandescent electric.

At the north end was a small enclosure formed by a counter about eighteen inches wide, upon which was a wire netting screen arranged

like the screen around a bank counter or tool room. Behind this counter and about three feet distant at the end was a closet constructed entirely of sheet metal, with sheet metal shelves and sliding sheet metal doors. This closet was nine inches deep, seventeen feet long and about seven feet high. At the opposite end of the room, about fifty feet distant, was a smaller closet about three feet deep, six or seven feet wide and seven feet high. Both of these closets contained inflammable and non-inflammable film in rolls. These films were not in boxes, but were stacked on the shelves. On the counter were several rolls of film, and beneath it some baskets were a few scraps, pieces of damaged films, etc.



Miscellaneous Fire No. S-9469.

In the center of the room were ten tables, each furnished with reels and an opening with a ground glass window, beneath which was an incandescent lamp, the films being rolled from reel to reel, passing over the ground glass windows so that the operator could detect imperfections and cut them out. The cut ends of the films were cemented together with amyl acetate cement, each operator being provided with a small bottle holding about one ounce or less for this purpose.

The method employed in this room was as follows. Each operator received one film at a time from the forewoman, whose place was inside of the screen at the counter. As each finished her film she returned it and received another. In this way the amount of loose films was kept down to a minimum.

As the care and cleanliness of the place as a whole were excellent and the owner fully appreciating the hazards of the business, it is fair to assume that no unusually hazardous conditions were present.

About 5.30 p. m., while the plant was in operation, the forewoman, or whoever was behind the counter, stepped to an adjacent dumbwaiter, and in a short time, perhaps a few seconds or minutes, some films (as it is thought) at the northerly end of the counter burst into flames. There was no apparent cause, and judging from the statements of the witnesses, the room seemed to be at once enveloped in flames, accompanied by the heavy acrid smoke peculiar to burning pyroxylin. The superintendent, followed by one or two male employees, immediately entered the room with chemical extinguishers, but as far as could be learned the sprinklers were already in operation, and it is stated that the whole thing was over in about fifteen minutes. No one was injured, but practically all of the films in the room were either destroyed or ruined and the machinery was more or less damaged by water and smoke. The paint in the room was blistered and smoked. Several windows were broken, evidently by heat, but absolutely no trace of anything resembling an explosion. The clock, some twenty feet or so from the fire, did not stop, and the telephone within ten or twelve feet was not injured except by smoke. A glass bottle containing about four pounds of amyl acetate stood on the window sill within ten or twelve feet of the fire and was not injured. The superintendent stated that a blast of heated air from the room caused the doors to swing outward, and this rush of heat was easily traced by the open sprinklers in the hall.

The difference in inflammability between the two kinds of films was very apparent, as the inflammable film burned in most cases to a small heap of ashes, while scattered all around among these little heaps of ashes were rolls of other film, which, while being ruined, were only scorched or blistered. Films in the closet at the other end of the room were only blistered.

There were thirty sprinklers in the room, all of which opened, as well as nine out of ten in one hall and two sprinklers in a short hall at the opposite end of the room, also one or two sprinklers in the skylight at the top of the light well in the hall.

Streams were brought in from standpipe hose and the local volunteer fire department arrived on the scene, but there seems to be no reason to doubt that the sprinklers practically extinguished the fire.

The most reasonable supposition as to the cause of the fire is that an incandescent bulb, situated two or three feet above the spot on the counter where the fire occurred, burst from some unknown cause and the heated glass or filament dropped on the film, igniting it. It is possible that the film might in some way have come in contact with the bulb, as a piece of the scorched film was noticed hanging over the top of the netting screen at the other end of the counter. There may have been another piece over this end which came in contact with the lamp. Other than this, there is no apparent reason why the film should have ignited. All of the occupants of the room were girls, and it is hardly likely that there were any matches about. There were no heating pipes, flues or anything near the spot where the fire started which could have ignited the film, except the incandescent lamp.

The principal point brought out by this fire appears to be a further demonstration of the fact that when moderate quantities of the material are on fire they are easily extinguished by automatic sprinklers under fair to good water pressure. Loss, $7,500.

H-5172. Fertilizer Works. Plant was quite extensive and has been in the one location for over thirty years. The business was manufacturing of fertilizer from animal offal (grease and bones) only.

The extracting of grease was confined to three one-story buildings. The building in which the naphtha extracting was done was separated from the still house and the grease house, the two latter buildings being divided by a wall between but communicating through opening protectedby a fire door.

The building wherein the fire occurred contained the stills for separating the water and grease after the naphtha process. The stills were heated by a steam coil resting in the bottom of the tank. The water is evaporated into steam and is carried off to a hot water tank by a three-inch pipe leading from the top, this pipe being connected to that leading from the other stills. At times some of the stills are empty and it is possible that the ruptured tank was empty at the time the explosion occurred. None of the employees were in the still room at the time. The man who attends to the stills was in an adjoining room, and as he was killed, no definite information regarding the conditions could be ascertained. The accident started with a violent explosion, which took away the upper portion of the still. The still was fifteen feet high and eight feet in diameter. The rupture occurred where the upper portion was attached to the basin, which, tearing away from the rivets, was lifted and projected through the roof, landing seventy-five feet distant. A flame of fire attended the explosion, sending a sheet of fire laterally, burning several employees who were in the yard. Another explosion followed, blowing off the top of another still. As the three buildings were well isolated from the rest of the plant, the fire was confined to the still buildings, with slight damage from heat to the others.

The large extracting tanks, containing naphtha, remained intact. The pipes leading from them became broken, which allowed the naphtha to burn like a torch, thereby preventing escape of free vapor and possible explosion.

As the force of the explosion was such as could only occur with an inflammable volatile substance, it is possible that the still was entirely or partly empty and some naphtha may have been carried over through the pipe which is connected with all of the stills. But how the ignition occurred could not be ascertained, as no fire or lights or wires were used inside the buildings and the premises were free from naphtha vapor, the stills intending to contain grease and water only. Instances have occurred where a leakage of steam from a crack in the pipe has developed a static electric spark, and if this action occurred inside of a still empty of solid substance but filled with an inflammable gaseous vapor, ignition and explosion would follow.

This action has occurred with steam and gases at high pressure, but it is not known at what pressure it may occur. The pressure of the stills was as stated, fifteen pounds.

The theory of the possible presence of the conditions mentioned with results is the only plausible one of the cause of the fire.

H-5354. Manufacturing Bleaching Powder. The group of buildings destroyed by this fire consisted of cell house, one high story, heavy timber construction; three-story lead bleach chambers, 62 feet away to the southeast and parallel, mainly of light joist construction; the four-story concrete bleach chambers, adjacent and parallel to lead bleach chambers, constructed of reinforced concrete with exception of post and timber roof with joist lantern; fire also severely exposing the one-story brick timber constructed repair shop on south and brick timber constructed drum house on the north, and other small buildings, such as fan house, wooden brine tanks, etc.

The fire started in the frame cell house at 12.40 a. m. while plant was in operation. The first alarm of fire was given by an outsider about one-half mile away who saw blaze breaking through roof. Employees had already discovered fire and had attempted to phone the fire department, but were unable to reach telephone central. They later turned in alarm from box near plant, but this did not register as first alarm was already ringing in. The fire was fought by employees with private yard hose and public fire department. There was a partial failure of the private electrical fire pumps, due to current being cut off at power house.

Details of the cause of fire are unknown, but as near as could be ascertained a new electrolytic cell, used for decomposing sodium chloride brine into chlorine and caustic liquor, became overheated and the paraffine oil with which these cells were insulated boiled out and ignited, spreading fire to woodwork of frame building. Each of these cells has flat narrow compartments on each side and end which contain an insulation of several gallons of so-called "paraffine oil," a petroleum product having a high flash point. The compartment along each side has an opening about one inch wide at the top and six or seven feet long where the oil is exposed to the air, and it is probable the oil became hot and boiled out at this point. The employees in the cell house are said to have noticed a small fire near the cell which is supposed to have caused the fire, and after running to the power house and having the power shut off, they procured a fifty-gallon chemical fire engine from the nearby repair shop and proceeded to fight the fire. The fire, however, had spread considerably by this time and alarm was given to other men at plant, and one of them, after failing to get the telephone central, pulled the fire alarm box as noted.

Private hose lines were gotten out but no streams could be operated, as a switchboard attendant at the power plant either saw or heard of the fire and had shut off the current, thus shutting down the private fire pumps. By this time the nearest city hose company, 1,200 feet distant, arrived and used a line of hose from a city hydrant, which gave a comparatively weak

stream with little effect on the rapidly increasing fire. A second hose company came over two miles and used two hose lines with the assistance of the hook and ladder company which also came over two miles. Firemen state hose streams were weak and had little effect on the fire, which soon communicated to the lead chamber building sixty-two feet distant.

About twenty minutes after the alarm the six-inch waterworks valve, leading from the ten-inch city dead end main, was opened by order of the fire chief, which gave city water to the private hose lines. The pressure was then too low, however, for effective work on so hot and large fire areas.

Sometime between twenty and forty minutes after the alarm, the assistant treasurer of company succeeded in getting the power company to put on the current. The private fire pumps were then coupled up in series and were operated at seventy to seventy-five pounds pressure, giving good pressure to from six to ten streams operated from the private hydrants. These streams were, however, not available until the fire had a good hold on the three-story lead bleach chamber building.

About the time the private pumps were put into service two more hose companies, a hook and ladder and a steam fire engine of the city department arrived in response to a second alarm. The effort of the combined public and private forces were of no avail in saving the top floor of the concrete bleach chamber building, but found no difficulty in quenching the fires which had started in the repair shop, brine pump pit, the drum shop buildings, and in cooling down the fire in the bleach chamber buildings, so as to save the lime house building.

The private fire equipment consisted of two 1500 gallons vertical single Morris eight-inch centrifugal pumps operated by direct connected 100 H. P. motors. Current came from company's power house through two sets of wires mainly overhead. Company receive all power from the power company, the current coming into the local power house, where it is reduced in voltage by transformers. The pumping station is located on Niagara River, and discharges water through about 500 feet of mainly fourteen-inch pipe to the eight inch and six-inch yard mains which supply seven well arranged double hydrants, also water for factory and processes. These pumps deliver water at forty pounds at 1,500 gallons per minute each, and when in series give about this amount of water at seventy-five pounds. About 800 feet of two and five-eighths inch cotton rubber-lined hose and four or five nozzles (one and one-eighth inch) and two fifty-gallon chemical fire engines complete the equipment. When employees endeavored to use this equipment they found that the pumps had stopped because the power company's central station men had shut off the power. When an official succeeded in getting power put on, the fire was too far advanced to do much of anything. At times the pump motors were heavily overloaded, and fuses were blown until wire jumpers were put in place; as many as ten or eleven streams are said to have been going at one time. The department chief states that when he arrived the fire had already ignited the three story lead bleach chamber building some eight or

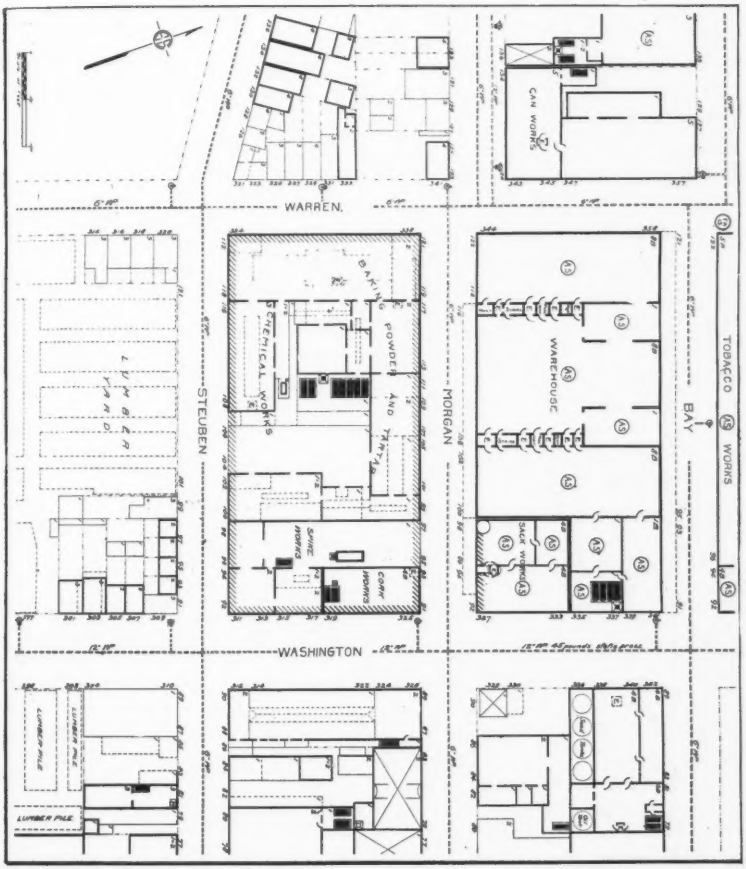
ten minutes after alarm, and that stream which the first fire company was operating was so weak as not to be effective; that private hose lines were without water on account of failure of electric fire pumps, and that the second fire company also could obtain only weak streams.

The damage to the buildings was considerable. The contents of the cell house were mainly the cast-iron electrolytic cells, which were seriously damaged, many being cracked. The lead bleach chambers were destroyed, and serious damage resulted to the concrete bleach chambers. The top floor had a wooden roof, which in burning, seriously damaged the valuable machinery on this floor. The second and third floors contained large concrete bleach chambers, the damage to which could not be ascertained at this time. The first floor contained about 800 pound drums of finished bleaching powder, a large number of which opened, due to the severe heat. Very little machinery was located on this floor. Loss estimated between sixty and seventy-five per cent.

H-5613. Conflagration. Fire that broke out early on the evening of August 17th in the warehouse district of Jersey City, N. J., destroyed one entire block of business buildings and factories, besides endangering the homes and lives of families living nearby and severely injuring many firemen. Fire was not under control until after midnight, when it was controlled with the assistance and help sent from neighboring cities.

The block, which was practically destroyed, consisted of the following buildings and occupancies: Building Nos. 319–325 Washington Street and Nos. 91–93 Morgan Street was occupied as a cork factory, and was four stories in height, of brick, ordinary joist construction. Building Nos. 95–97 Morgan Street through to and being Nos. 96–98 Steuben Street, with ell being Nos. 311–317 Washington Street, occupied as a rolling and spike mill, was one and two stories in height, of brick and frame (predominating) ordinary joist construction, with open communications throughout. Buildings Nos. 324–338 Warren Street, Nos. 100–122 Steuben Street and Nos. 99-121 Morgan Street, were occupied as a baking powder and chemical works, were of one, two and three stories in height, of brick and frame ordinary joist construction, with open communications throughout, and had many frame roof structures such as pent houses, ventilators, skylights, etc.

Fire was discovered at 7.47 p. m. by night watchman of the plant on the northwest corner of Washington and Morgan Streets, and was noticed on the third floor of the cork works on the southwest corner of same streets. Alarm was turned in by police from box corner Bay and Warren Streets (one block west and one block north) and was received at fire department headquarters at 7.50 p. m. This alarm called out engines Nos. 1, 2, 3 and 4 (chemical), and trucks 1 and 6. So rapid was the spread of the fire through the cork works that when engine No. 1, located at Nos. 155, 157 Morgan Street, but one block from the fire, arrived, the entire building was afire from basement to roof. Five minutes after the first alarm the fire was assuming such threatening proportions that a third alarm was turned



Miscellaneous Fire No. H-5613.

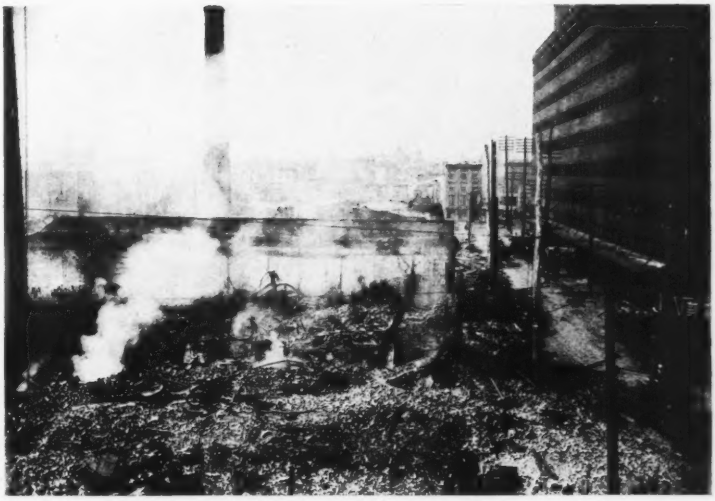
Plan of burned area and adjacent properties. Buildings destroyed shown by shaded lines.

in, being received at 7.55 p. m. calling out engines Nos. 5, 6, 7, 9 and 10, and truck 2; and at 8.11 p. m. the general alarm was rung in, calling out engines 12, 8 and 17, and trucks 3 and 5.

In face of this force the fire spreading to the westward and embracing the entire block as well as seriously threatening adjacent blocks, it was considered advisable to call for aid and New York City, Bayonne and Hoboken were called on the telephone, about 8.30 p. m. New York promptly responded with engines 7, 18 and 30, arriving at the fire about 9.30 p. m. Hoboken sending a truck company to No. 2 house on Ninth Street, covering the northern section of the city, and Bayonne sending an engine company to No. 13 house on Linden Avenue covering the southern section of the city. Aided by the reinforcements the fire was checked, after having practically wrecked the entire city block bounded by Warren, Washington, Morgan and Steuben Streets. Some damage was done in Building Nos. 312–326 Washington Street, as well as to Nos. 92–98 and 100–122 Morgan Street. The tangle of electric wires in the immediate vicinity of the fire, some carrying high potential currents, was responsible for the death of one fireman and impeded the work at the fire. The water supply was adequate at all times, no difficulty being experienced with this important service. Owing to inadequate police lines the crowds impeded the work of the firemen at times. Wind velocity at time of fire was seventeen miles per hour, direction due east, shifting between 11 and 12 p. m. to northeast.

So far as the fire itself was concerned, there was no particularly interesting or important feature to be reported. The character of construction and occupancies formed a situation from which little else could be expected than that which happened.

The principal interest in the fire centres in the block north of the burned district, which furnishes instructive examples of fire protection. Immediately opposite the cork works was Nos. 92–98 Morgan Street, 327–333 Washington Street, a four-story brick mill constructed building with fire walls dividing it into three sections, having ordinary thin glass frame sash windows facing the burning building. This building, occupied as a sack works, was protected by a complete wet-pipe system of Grinnell glass disc sprinklers having for supplies a 15,000-gallon wood gravity tank elevated twenty feet above the roof on a steel structure located on the southwest corner of a westerly section, and two 9,000-gallon wood tanks elevated fifteen feet above the roof on a wood structure over the elevator and stair tower, the secondary supply being a Worthington National Standard Underwriter Pump, 16 by 9 by 12 inches, 750 gallons, located in pump room in northeast corner of the basement, taking suction from a 200,000-gallon reservoir in the adjacent warehouse building. This pump supplied the automatic sprinklers as well as a six-inch standpipe in the stair tower with hose outlets on each floor. In addition to these supplies the system was connected by an eight-inch line into the sprinkler system of the adjacent building.



Miscellaneous Fire No. H-5613.

Showing ruins of fire wall between Spike Works and Baking Powder factory, with the warehouse building at the right.

The heat from the burning cork factory soon cracked the glass and ignited the doors and window frames of the sack factory, promptly fusing the automatic sprinklers in the first bay adjacent to the windows, and the water curtain formed thereby was so efficient that no fire entered the building, very little charring or evidence of fire being observable although the window and door frames were almost completely consumed. In all twenty-six sprinkler heads were in operation, and these in connection with very efficient aid from employees using fire hose, prevented any further damage inside the building. Several lines of hose were led from the standpipe to the roof and used in keeping off fire at this point as well as protecting the sprinkler tanks and supports—the iron structure supporting the 15,000-gallon tank shows no evidence of being weakened although the tank itself was considerably charred. The two smaller tanks and their wooden supporting structures were also badly charred. The entire damage to this plant, mostly water, including the replacement of the gravity tanks is placed at approximately $2,500.

Adjacent to this plant and occupying the balance of the block bounded by Morgan, Bay, Washington and Warren Streets was an eight-story brick mill constructed, scuppered floor building, occupied as a private warehouse, the main building being divided into three sections by double fire walls which house the elevators, stair towers, vents and passageways, same being

of fireproof construction. The window openings were protected by wired glass in metal frames.

A complete wet-pipe system of Grinnell glass seat automatic sprinklers is installed throughout the premises, some few portions being protected by the dry-pipe system, having for supplies two wood tanks enclosed in brick towers of 25,000 gallons capacity each, elevated twenty-three and a half feet above the highest line of sprinklers, and two Knowles National Standard Underwriter, 16 by 9 by 12 inches, 750-gallon pumps, taking suction from a 200,000-gallon reservoir and directly connected to sprinklers as well as to stand pipes. System is also connected by an eight-inch pipe into system of sack works aforesaid so that pump of same is also available on this equipment. Absolute protection to this plant was afforded by the wired glass windows, while same were cracked by the heat, there were no sprinkler heads fused and outside of cracked glass and scorched paint no fire damage to building or contents ensued. As, however, a number of lines of hose were laid and used there will be some damage by water. Between the two plants some 105,000 gallons of water were drawn from the reservoir by the fire pumps.

While the work of the automatic sprinklers in the sack factory is a most remarkable example of their efficiency against a rather severe exposure fire, a most interesting example of full protection is afforded by this fire to the adjacent warehouse building. The owners of these two plants are to be congratulated upon their fortunate escape from a serious situation, but more particularly upon their foresight in providing such efficient safeguards that so admirably protected their plants.

Fire Causes.

The fires here given are selected to illustrate defects, either of construction or superintendence in the classes of property indicated.

H-4721. Fur Hat Factory. Fire is thought to have been caused by a gas heated finishing iron which was left with gas burning.

To guard against a recurrence, a special watchman is now detailed to go through plant every night after closing and see that all gas is shut off throughout building.

H-4998. Laundry. Fire was caused by the explosion of a gasolene gas generator located inside of laundry. Explosion threw burning gasolene over building, and building and contents were a total loss. Gas generator was of modern manufacture, but had not been tested or listed.

Gasolene gas generators with inside carbureters are dangerous, as they introduce gasolene in liquid form inside the building. Only those machines which have been tested and listed should be used. These machines are constructed so as to minimize the danger to the greatest extent possible with a hazardous device of this nature.

H-5369. Manufacturing Canvas Belting. Fire occurred in a brick building, of open joist construction with plastered walls, occupied as a saturating or treating house for the canvas belts. Belts were passed through a tank containing a heated mixture, thought to be compounded of mineral rubber, palm butter, turpentine, naphtha and other oils. Tank was heated by hot water and steam supplied by a boiler about fifteen feet distant. Boiler furnace was defective, as a plate enclosing fire box had buckled, causing a crack at seam. On the morning of the fire a tank of this "patent tar" was undergoing its first heating, at which time inflammable vapors are given off. These were ignited at boiler furnace, flashing to tank.

In rebuilding, tank was placed inside of main building in a separate room, well cut off and equipped with standard fire doors. Boiler was also placed in separate room.

H-5379. Mattress Factory. Building was of brick, ordinary open joist construction. Fire started on the third floor in a fibre and hair picker,

caused by foreign substance in stock. The picker room was not cut off from main room nor was delivery boxed, and fire spread into the large quantity of inflammable material on floor, and was soon beyond control.

Pickers should be located in a fire resisting room, openings equipped with approved automatic fire doors. Such rooms can be easily constructed by applying wire lath and plaster to walls and ceiling, covering floor with metal.

H-5381. Tannery. Fire started in the fan enclosure of the hot air heating system. Mechanics were repairing fan, using a large kerosene blow torch. This ignited the oil and dust which had collected in fan, fire spreading to the detached buildings of plant through the heating pipes and opening in wall near ceiling of fan room. Loss large.

Fans and systems of this type should be thoroughly cleaned at frequent intervals, as fans and pipes are soon coated with dust and oil or grease from bearings, which burns fiercely when ignited. A system of dampers or stops placed in pipes when repairing fans or enclosures would prevent the spread of fire.

H-5383. Motion Picture Theatre. Fire occurred during the afternoon exhibition of motion pictures in the brick vaudeville theatre, which was occupied during the summer season for motion pictures, being caused by an inexperienced operator allowing film to be exposed too long to rays from light. Picture machine booth was of standard construction except for a few minor defects, and fire was confined to the inside of the booth, burning only the film.

Experienced operators only should be licensed to operate machines.

The requirements for the construction of a standard booth are as follows: Picture machine must be placed in an enclosure or house made of suitable fireproof material, be thoroughly ventilated and large enough for operator to walk freely on either side or in back of machine. All openings into this booth must be arranged so as to be entirely closed by doors or shutters constructed of the same or equally good fire-resisting material as the booth itself. Doors or covers must be arranged so as to be held normally closed by spring hinges or equivalent devices.

H-5393. Grain Elevator and Warehouse. Fire was caused by a blazing ball of excelsior saturated in oil which dropped from a toy balloon into loose hay scattered about in yard of warehouse. Fire at once spread to buildings, causing a total loss.

Ordinances should be passed prohibiting the sale or use of fire balloons or similar devices.

H-5396. Manufacturing Tar Compounds. Buildings were occupied for the manufacture of materials for paving blocks and roofings. Fire started from unknown cause in a shed near engine room, rapidly spreading into large storage shed filled with barrels of tar. The barrels of tar soon burned through, or burst, and blazing tar flowed over the ground in all directions, and entire plant was soon in ruins. The burning tar seriously endangered the safety of employees and firemen fighting fire, but only one was injured. Loss, $15,000.

Tar storage buildings should be isolated. There should be a ditch around storehouse of sufficient size to contain contents of shed, or a dike to turn the stream of blazing tar away from main buildings, should same become ignited.

H-5399. Mattress Factory. Fire was caused by the grounding of a 2,300 volt primary electric wire, passing between boiler and engine house and woodworking building, upon the metal shaving conveyor to boiler house. This conveyor apparently grounded on brick wall inside of woodworking room, fire starting at this point. Wire was found down, and in contact with metal conveyor system after fire.

H-5409. Mercantile. Porter stepped on match while filling gasolene lighting system.

Prohibit the use of other than safety matches.

H-5421. Foundry. Fire occurred from unknown cause in the frame composition roofed automobile house, used for storage of a large truck. During fire the thirty gallon gasolene tank of auto exploded, scattering fire one hundred feet west in yard. Fire also exposed a number of oil barrels stored outside in yard. These proved a severe hazard and disadvantage to the firemen. Building and contents were totally destroyed.

Automobile house should be detached as far as possible from main buildings. Oil barrels should not be stored near buildings in yard, and should be left with open bung hole at bottom.

H-5425. Varnish Works. The varnish which was being made at the time fire occurred is used by the rubber trade, and consists of a mixture of boiled linseed oil, gum, benzine and turpoline, a turpentine substitute, all having a rather high flash point.

The linseed oil and gum are boiled in metal kettles on trucks over coke fires in chimneys. These kettles are allowed to cool by standing in the open air from twenty to forty minutes, and before being taken into the mixing building hose is played on the outside to insure the extinguishment of any spark or hot soot upon them. The employee mixing the turpoline and oil had stirred in about two gallons, when there was a dull explosion and flash, and he, with other employees, ran from building, closing doors.

The cause of fire is unknown, the only theory being a spark that had not been detected and extinguished. The building contained two or three finished kettles of varnish, and two which were being mixed. There were also three 100-gallon closed tanks partly full of varnish, and one fifty-gallon tank of turpentine, turpoline and benzine. Buried beneath the building, with a vent into building, was a 300-gallon tank of benzine. This was not injured, but the contents of all other tanks were consumed, and added greatly to the fierceness of the flames.

It is possible that the linseed oil was too hot at the time the turpoline was added, or that spark on the outside of kettle ignited benzine vapors present.

H-5439. Garage. Fire originated and was confined to the fifth, top floor of the brick open joist constructed garage and auto sales building. Fire was caused by spontaneous combustion in rubbish and sweepings placed in wooden boxes and barrels.

Approved waste cans should be installed, and their use enforced. These should be inspected each day at close of work to insure their being emptied.

H-5440. Garage. Building was of frame construction, with wooden floors, occupied as a garage, bicycle repairing and vulcanizing. Fire occurred at vulcanizer. Workman in starting gasolene burner allowed gasolene to overflow burner cup, and run onto floor. Vapors were ignited when he struck match to light jet, causing a flash fire, fatally burning workman, and completely destroying building. The gasolene storage tank buried in ground under building was not damaged by the fire above it.

Flooring under and around vulcanizer, or appliances heated with gasolene, should be of non-combustible material, or covered with sheet metal.

H-5484. Tobacco Factory and Warehouse. Fire was caused by sparks from steam-heating boiler furnace, igniting the shingle roof. The day had been hot and dry, and the shingles ignited easily. Fire was discovered in its incipiency, but before help could be called had spread rapidly, and could not be extinguished with the protection at hand. Building was located in the country, and was without public fire protection. Loss, $40,000.

Use fire retardant roofing coverings.

H-5519. Morocco Factory. Fire occurred at 3.30 p. m., caused by locomotive sparks on shingle roof of main building. This spread very rapidly, fanned by the wind. The efforts of bucket brigade to stop fire were futile. Horses for nearest town hose wagon were being used on street sprinkling cart, and it was fifteen or twenty minutes before hose streams were in service. Fire had gained such headway by this time that

efforts were directed towards protecting adjacent property. Numerous small blazes started on nearby roofs, which were extinguished by fire department.

Hose wagon should be kept in readiness to respond promptly to all alarms. Horses to be used for fire department only. Had fire department been able to respond at once, fire would probably have been extinguished with small loss.

H-5528. Hotel. Fire started in kitchen of hotel, caused by ignition of fat being heated on kitchen range. This ignited the grease and soot accumulation in hood and ventilating flue over range, which overheated and ignited woodwork around flue where it passed through floor, fire spreading in the sheathed ceiling.

Grease and soot are bound to collect in ventilating hood and flue and same should be of riveted metal construction, well insulated and protected from surrounding woodwork or ceiling. Where passing through floors or partitions, flue should receive the same protection as stove pipes.

H-5548. Dry Cleaning. This fire occurred in the naphtha cleansing department in a two-story brick and reinforced concrete building which is detached from the main building. The fire was started by an employee stepping on a match. This flared up and ignited the fumes of naphtha, which in turn ignited some clothes which were in the "extractor," which is an ordinary centrifugal dryer. As soon as the fire was noticed the men, who are instructed how to act in case of fire, ran from the building, shut all windows and shutters and turned on the two steam jets. Fire was extinguished in a few minutes. The owner takes every precaution against fire, draining the naphtha as much as possible from the cleansers before taking out the clothes and putting them in the "extractor." The cleansers are fitted with tight metal covers which are lowered from outside, at the same time draining off the gasolene through a quick opening valve. These were immediately lowered, the only damage resulting being to the contents of the "extractor." If the extractor could be fitted with somewhat the same arrangement as is on the cleansers, the spread of fire would be lessened.

Use safety matches.

H-5550. Furniture Factory. Fire was caused at 2 p. m. by defective wiring on an extension electric lamp. Employee using lamp pulled cord so as to break insulation, causing wires to short circuit. Insulation ignited, setting fire to some oily waste in employee's hands which he threw into finishing oils and paints nearby. Loss, $30,000.

Extension lamps should be wired with flexible wire having an approved insulation covering. Lamps should be placed and arranged so

that no undue strain will be brought to bear on wire during use. Cord should never be hung over nails or sharp corners. This will injure the insulation.

H-5556. Dry Cleaning. Fire was caused by employee stepping on match in building used for dry cleaning with gasolene. Building was one story high, constructed of eight-inch tile, composition roofing on wood sheathing and cement floor. Building and contents were a total loss.

Prohibit the use of any but safety matches.

H-5551. Manufacture of Clay Products. Fire occurred at 1.30 p. m. in the main frame constructed manufacturing building. Oil is used in the plant for fuel. Valve in feed pipe was out of order and employee in repairing same broke valve which allowed oil to overflow and ignite.

A shut-off valve should be installed in addition to the regular valve. This will permit the shutting off of fuel oil while making repairs or adjustments.

S-9778. Steam Laundry. Fire started in the clothes dryer in steam laundry on the fourth floor of the brick, ordinary joist constructed, tenant manufacturing building. Clothes dryer was of frame construction lined with large sheets of galvanized iron nailed on with nail heads exposed. Dryer was heated with live steam at 85 pounds pressure; steam coils well bushed and resting on iron at bottom of dryer. Fire was caused by the woodwork, which had gradually carbonized until fire ensued. One sprinkler opened outside of dryer and held fire in check.

Dryer should be lined with asbestos and lock jointed tin and equipped with automatic sprinklers.

S-10030. Metal Worker. Fire started in a metal japan oven, heated by open gas jets inside of a metal cylinder located under the dipped parts being dried or baked. The iron trucks and trays as well as heater were covered with a considerable accumulation of lacquer which had dripped from the dipped stock. This apparently became overheated, and ignited on heater.

Heater should not be located where drippings from stock can accumulate on same. Had oven been properly cleaned there would have been but little inflammable material for flames to feed upon.

S-10032. Furniture Factory. Fire occurred at 3 p. m. in the one-story brick boiler house cut off from main buildings. Fire was caused by spontaneous combustion in a box of shavings or oily rags that had been brought to boiler house to be burned. There was no fire under boilers at the time, and the oily material was left in the wooden box.

S-10037. Full Process Knitting Mill. The fan in the Sargent stock dryer became loose, and striking iron casing caused sparks which ignited stock in process. Dryer was located on first floor of a four story stone building. Although two sprinklers inside of dryer opened, fire in some way spread outside and ignited a small pile of stock on floor, spreading into engine room where it was carried by the belts through open belt hole into card room on third floor.

Dryer and fans should be frequently inspected and cleaned. Pipe openings in walls should be protected by a closely fitting metal collar or stopped with cement. Belt openings should be enclosed with wire lath and plaster or other equally good fire-resisting material.

S-10049. Metal Worker. The case hardening process was conducted in a detached building, the hardening furnaces being heated by fuel oil burners. The main supply of oil was stored in a 10,000-gallon tank located outside of building. This was partially burned by the fire. The oil was pumped from the tank to a small standpipe in the building from which oil fed to burners through a one-inch pipe.

Employee states that the one-inch feed pipe broke off in the threads at one of the fitting joints. There was apparently no reason why the break should have occurred at that point, as oil pressure in pipe was only twelve pounds. The escaping oil and building was ignited, and fire burned so rapidly and fiercely that walls of building were badly burned and roof practically destroyed before fire was extinguished.

Equip feed pipe with a quick closing valve which can be shut in case of a break in the system. Case hardening building should be of fire resisting construction.

S-10053. Furniture Factory. This was a roof fire of unknown origin, but probably caused by sparks from a foundry located across the street. Building was occupied as a general storehouse, and was two and a half stories in height, of frame construction with shingle roof. Fire was discovered on roof in its incipiency, but before arrival of fire department had spread well over roof, which necessitated the use of large quantities of water thoroughly soaking contents of building. The roof was considerably burned, but there was practically no fire below the attic.

Shingle roofs near dangerous exposures should be replaced with fire retardant material.

S-10078. Planing Mill. The automatic shavings feed pipe from shavings vault was connected to boiler furnaces. Employee failed to disconnect same, and fire communicated to shavings house.

S-10156. Manufacturing Abrasives. Fire was caused by the overheating of an electrically heated bake or vulcanizing oven. Employee had

been experimenting with oven, and left building without opening switch. Four sprinklers extinguished fire.

A low candle power electric lamp installed between switch and heater would show at a glance whether or not the switch is open and would tend to prevent its being left closed through oversight.

S-10196. Clothing Factory. Fire occurred about 9 a. m. at a small table on which was an electric pressing iron. Although some of the employees were detailed to open all switches before leaving premises, it is probable that the switch was forgotten and the iron becoming overheated ignited table. There was apparently no pilot light on the iron.

S-10213. Car Barn and Repair Shop. Fire occurred at 10.30 a. m. in the woodworking department on first floor of the two-story brick, ordinary construction, car barn. The insulation on one of the fields of the large electric motor was defective, which short-circuited, igniting the insulation, oil drippings and sawdust around the motor.

An enclosed type of motor is recommended for use in dusty places, being preferable to wooden boxing. If this is not practicable, motor should be enclosed in a readily accessible dust-proof enclosure, sufficiently ventilated to prevent an excessive rise of temperature. Such an enclosure could be made with glass sides, which would permit motor to be plainly visible at all times.

S-10234. Cotton Mills. Fire started on second floor of waste house in a bin of red dyed cotton yarn waste, due to spontaneous combustion. This yarn had been in the bin for about a week and was converted into waste by the dyeing process, which weakened the fibre, making it impossible to beam the yarn.

S-10236. Cotton Mill. Fire occurred at 10 a. m. in the wooden fan house, caused by a dry bearing on the driving pulley located at the opposite side of house from the fan which it operated. The fan drew the fire through the house, blowing it into the steam dryer in the rebeaming room for drying warp yarn, where it was first noticed. Fan was connected to dryer by a wooden flue. The fan house and wooden flue were practically destroyed, fire being held in check at dryer by the use of hose streams.

Automatic journal alarms installed on fan bearings and driving pulleys would eliminate the possibility of a hot bearing not being discovered until fire ensued. Fans and blowers are liable to overheat on account of the high speed at which they run, and should be cleaned and oiled each day. Fan house or room should be of fire resistive construction, as fire starting at this point will be blown through all ducts.

S-10238. Furniture Factory. Shavings blower system discharges into a brick sprinklered shavings vault in boiler room, the shavings being

shovelled from vault to boiler. The heavier refuse and pieces are carried to boiler room by hand. A small pile of refuse had collected in boiler room which was undoubtedly ignited by sparks from boiler.

All refuse should be kept in a fireproof refuse vault equipped with a self-closing tin-clad door. Boiler room floor should be kept clear of shavings.

S-10239. Warehouse. Fire was discovered in the elevator motor by employee. Alarm was given to fire department, in the meantime employees using water pails on blaze. Power was immediately shut off and blaze extinguished.

Motor and electrical connections were known to have been in defective condition. It had been the intention to have system overhauled and placed in good condition, but this had been deferred. Negligence.

S-10240. Paper Mill. The first indications of fire were when it flashed up over paper machine. This was undoubtedly caused by a dry bearing in which the bronze bushing was found destroyed after fire. Employees immediately manned fire hose supplied by gravity tank, and fire pumps were started as a precaution, as city water was not connected to yard system. The wooden hood over paper machine was equipped with 286-degree sprinklers, and while these opened promptly the fire flashed by them over the dry wood, charring the wood in many places. Before the fan in hood could be stopped, fire had been drawn through flue into fan house, which was practically destroyed. The heat from the broken paper, grease and oil in the machine pit, opened twenty-three sprinklers. The only damage to building was to the ceiling near where flue passes out through the roof.

S-10245. Warehouse. Fire was discovered in some empty boxes that had come in contact with the smoke flue in basement. The boxes are now kept well away from smoke flue.

S-10246. Incandescent Electric Lamp Factory. The one-story brick fireproof boiler house at east end of plant was temporarily used for storing wooden incandescent lamp racks on account of crowded condition of main plant. Between 700 and 800 of these racks had been brought into the boiler room, and piled at a safe distance from boilers. Fireman customarily removed ashes as they collected, but as a freight train blocked passageway he evidently filled his wheelbarrow, leaving same where a spark or heat from ashes ignited the racks. Fire was extinguished a few minutes after discovery, but with the exception of about a half dozen racks, all were destroyed.

Boiler room was not damaged, except that it will need repainting. Fire did not spread into main building on account of good fire walls and automatic fire doors, which gave efficient protection. At the east end, however, there was a small opening around a steam pipe, which had not

been tightly stopped, and sufficient heat passed through to open one sprinkler head near wall.

Boiler rooms should not be used for storage purposes. Openings around steam pipes passing through fire walls to be tightly stopped.

S-10248. Printing. A temporary frame wall had been erected between old building and new addition, and was covered on the outside with tar paper. A small water pipe passed through this temporary wall, supplying water for mixing mortar, etc. This became frozen, and workman built a small fire under same to thaw it out. Fire ignited the tar paper, and set fire to the partition. Fire department alarm was given, and fire attacked with a chemical extinguisher, which extinguished fire before arrival of fire department. Sprinklers in old building did not operate.

S-10265. Furniture Factory. Fire occurred at 4 p. m., caused by sparks from boiler stack igniting an accumulation of sawdust, chips and shavings which had collected on roof. Boiler fuel at time of fire was shavings, and the stack having no spark arrester allowed sparks to fly. Fire was discovered by inspectors who were testing fire pump. They immediately gave alarm, and procured fire pails (which were found empty), and filling them, extinguished fire with the assistance of one hose stream.

In woodworking properties, especially where shavings are used for fuel, roofs should be kept clear of sawdust and shavings. This care should also extend to the yard. Smoke stacks should be equipped with spark arresters.

S-10276. Woodworker. An electrically heated glue pot of the legless type was left with current on at closing time. This was arranged to plug into lamp sockets, and was moved about as needed. Being portable they had never installed a pilot lamp in the circuit, and the night of the fire the workmen went home without opening switch. When the water boiled away the stand heated up, and ignited the wooden bench on which it stood. One sprinkler opened and extinguished the fire.

If plug is removed from socket each night this danger would be eliminated.

S-10279. Shoe Factory. Employee was cleaning shoe linings with naphtha when vapors ignited either at gas flame, twenty feet distant, or from someone lighting a pipe, the flames flashing through the vapor to an open metal pan from which the naphtha was being used. Metal pan contained about one-half quart of naphtha, while a ten-gallon can containing the main supply, usually about half full, stood nearby. The fire operated a thermostat and sprinkler directly overhead, which called the fire department, but the sprinkler had extinguished fire before its arrival.

So free a use of naphtha is not customary in most shoe factories, and should be prohibited.

Points of Interest from Fire Reports.

These notes are intended to illustrate the efficiency or inefficiency of signaling, retardant or extinguishing agencies.

Alarm Service.

S-9793. Woolen Mill. Watchman smelled smoke, and discovered fire in stock storage. Sprinkler alarm failed to operate. Cause not stated.

S-10032. Furniture Factory. Fire occurred on a Saturday afternoon while the plant was practically shut down. There were a few men in plant making repairs when the sprinkler gong was heard operating. Fire was found burning in a box of oily rags or shavings in boiler house. This was extinguished by the one sprinkler opened.

S-10039. Woodworker. Fire was discovered by an outsider who heard thermostat bell on outside of building ringing. The Grinnell sprinkler alarm valve connected to rotary gong, and thermostat system did not operate. After the fire it was found that while engineer thought sprinkler alarm was in service, in reality the three-way cock controlling alarm was closed, and had been so for some time previous to the fire.

S-10052. Woolen Mill. Employee gave alarm through push button on the thermostat system. The sprinkler alarm did not operate, probably due to the old lever alarm check not being sensible to the slight amount of water discharged through the one sprinkler head opened. The thermostat system also failed to operate. Thermostats were of the unreliable ether tube type.

S-10068. Tenant Manufacturing. Fire occurred at 6.20 a. m., after night watchman had left. Last round of watchman is at 5.30 a. m., and then plant is without watchman service until employees arrive at 7.30 a. m., with the exception of engineer, who arrives about 6 a. m. to care for boilers. Sprinkler alarm operated, and engineer hearing bells called fire department.

Watchman service should be extended to cover all time until the arrival of the regular day force.

S-10078. Planing Mill. Fire was discovered by employee. Electric sprinkler alarm, connected to fire department, failed to operate on account of circuit closing device being burned out.

It is obvious from the report that alarm service was not tested daily. Rule 33-c of Class G, Signaling Systems, states: "Systems to be tested daily by closing a circuit through the binding posts of alarm valve." Had this been followed the inoperativeness of system would have been known.

S-10151. Waste Paper Baling. Outsider heard sprinkler alarm bells ringing and gave alarm. There was no watchman. Fire originated on second floor among loose paper, evidently caused by the careless throwing away of either a cigarette or cigar, and had been smouldering for some time. When the fire finally broke out it was from all appearances very hot, opening nine sprinkler heads which held the fire from spreading. The sprinklers undoubtedly saved the building from partial if not total destruction. Without the sprinkler alarm calling the attention of outsiders the fire would soon have spread through the entire building through open hatches and open stairways, there being large stock of loose paper in the building. Damage to building slight, to contents considerable by water.

S-10247. Manufacturing Bottle Stoppers. It was customary for the watchman to start the gas fire under the heating kettle in the paper waterproofing department at 5.30 each morning. The waterproofing mixture is mainly wax, resin and copal. On the morning of the fire the gas burner was lighted as usual and the watchman made ready to open the factory.

About fifteen or twenty minutes after, the sprinkler alarm began to ring. The watchman, who was then on the ground floor, went up through the building looking for trouble on each floor. On the top floor, in the east section, he found one sprinkler in operation, and after satisfying himself that there was then no fire, he returned to the yard and closed the sprinkler valve. Fire was caused by defective kettle allowing contents to run onto burners.

Automatic Sprinklers.

S-9993. Mercantile. An employee was boiling a floor compound composed of beeswax and soap over an open gas burner, when same boiled over and ignited. The flames flashed up and opened a sprinkler directly over the kettle, which entirely extinguished the fire. The whole operation took place so quickly that employees did not have time to use the chemical extinguisher.

S-10043. Furniture Factory. Fire is thought to have been caused by sparks from cupola exposure igniting canvas curtain at end of dry

kiln. One sprinkler opened and prevented fire from entering kiln, although it could not extinguish fire in the curtain or under the eaves just outside of door.

S-10073. Woodworker. Fire occurred in paint shop on second floor of warehouse. Employee was dipping window sash in a dipping tank containing paint thinned with naphtha. In starting a new pile, when the first sash was placed on floor, fire started with a flash, evidently from a match. This ignited the vapors from the freshly dipped sash, flames spreading to ceiling and opening sprinklers. The operation of the sprinklers was so quick and decisive that two large dipping tanks within ten feet of where fire started were not ignited.

S-10141. Clothing Factory. The fire occurred under a twelve by forty-two foot wooden deck recently erected. Had the deck not been equipped with sprinklers, the fire would have gained considerable headway before the ceiling sprinklers would have operated or fire department arrived. Two sprinklers under deck extinguished fire with but slight loss.

S-10198. Tenant Mercantile. Fire occurring in a can of rubbish and sweepings located in hallway at 7.20 p. m., was extinguished by one sprinkler. The valve controlling these sprinklers was in a store on first floor and also controlled about half the sprinklers on this first floor. Valve was closed by the patrolman and left in this condition until the next morning when engineer replaced the fused sprinkler and turned the water on.

A watchman was left on the first floor by the patrol in command but there was apparently no reason why sprinkler was not at once replaced and system put into service after fire.

S-10237. Agricultural Implements. Fire occurred in a small dip tank containing about eight gallons of benzine thinned paint. The contents burned quickly and opened a sprinkler directly above. Sprinkler was controlling fire when employee threw several pails of water onto fire, overflowing tank and spreading the burning paint mixture over floor. Employees then confined their efforts to the burning paint on floor, sprinkler extinguishing fire in tank.

S-10260. Knitting Mill. Fire was first noticed in picker room by foreman, who was standing near the waste card in which it started. One sprinkler head immediately opened over card, and with the use of chemical extinguishers it was thought that fire had been extinguished. Foreman then decided to shut off sprinklers. He went to the basement and shut sprinkler valve, but on his return, finding that fire had broken out again, returned and opened valve. On reaching picker room again, finding the room full of smoke but apparently little evidence of fire, he again

shut off the sprinklers, but on being informed that fire was still burning he opened valve and sprinklers were left in operation for about ten minutes. By this time twenty-four of the thirty-four sprinklers in room had opened.

There was a decided lack of judgment on the part of the foreman in closing and leaving gate valve until he was certain that fire was entirely extinguished. Had the system not been shut off prematurely there is no reason why fire would not have been extinguished by the first sprinkler opened.

S-10282. Electric Car Barn. Car barn was a one story brick building, about 350 by 175 feet in area, well cut off into three fire sections. The roof was of plank on unprotected steel truss, and covered with gravel. Floor of earth. Distance from floor to roof twenty-eight feet, and distance from top of cars to sprinklers about fourteen feet. The central section contained four tracks, others five tracks each. There were two seven-foot curtain boards, spaced nearly equal distance, running across each section. The brick cut off walls were parapetted three feet, and the three openings in each wall were protected by double tin-clad fire doors.

The section in which fire occurred was used for storage of closed cars and not as an operating barn. There were about forty cars in this barn at time of fire, practically filling the entire area. Cars were mostly touching each other, end to end.

Building was equipped with Grinnell sprinklers, installed according to present rules, but without aisle lines. There were six dry valves with about 150 heads on a valve. Water supplies were from six and eight inch connections from an eight-inch street main at 50 pounds pressure.

Fire was discovered by workman at about 11.30 p. m., and public fire alarm was given. Fire apparently started in a concealed space back of car seats where the windows drop down. Car was located close to fire wall, being the third car from the rear and the sixth car from the front. Cars were immediately run out of the barn on discovery of fire, and with the aid of the six sprinklers opened, the fire was held inside of the car in which it originated until it also could be run out of the barn. Remaining fire was extinguished by fire department. The paint on two of adjoining cars was scorched, but the damage was practically confined to car in which fire started by the sprinklers.

Chemical Extinguishers.

H-5455. Gas Works. Fire occurred in a pile of charcoal screenings in yard. When fire was discovered extinguisher was brought and turned on fire by the superintendent. It began to leak around cap, and as superintendent looked to find cause of trouble there was an explosion which blew the cap into the ground and the tank about 50 feet into the air. The tank struck superintendent's head, fracturing his skull.

The extinguisher was not of standard construction, the explosion being due to the fact that there was an insufficient number of holding threads in the cap. It is stated that the extinguisher had been charged about two months before accident by the regular formula as given on extinguisher plate.

Great care should be used in selecting these extinguishers and in properly re-charging and assembling them after use.

H-5520. Stable. Fire was caused by sparks from a rubbish fire, igniting hay or paper through an open window. Employee discovering fire gave alarm, and owner used five chemical extinguishers, holding fire in check until arrival of public fire department.

S-10034. Cotton Mill. Lightning struck plant, igniting cotton on spinning frame. Employee extinguished fire with a hand chemical extinguisher. The scorching of spinning frame and yarn on bobbins was the only fire damage.

S-10040. Woolen Mill. Fire started in duster, spreading into about 3,000 pounds of stock piled and scattered around room. Batch was about forty per cent cotton, and the rapidity with which fire spread opened eight sprinklers. Employees used chemical extinguishers which, with sprinklers, extinguished fire without the use of hose streams.

S-10065. Mattress Factory. Spark struck from foreign substance in picker ignited cotton. Employees quickly extinguished same with eight chemical extinguishers. No loss.

Construction.

H-5460. Mercantile. Fire occurred from unknown cause at 7 p. m., in the sheathed ceiling between second and third floor.

Fire again illustrates the undesirable feature of hollow ceiling construction, as only early discovery prevented a large loss.

H-10041. Dye and Bleaching Works. Sprinkler spacing, arrangement and water supplies were good, but owing to defective construction, wooden sheathed walls without floor stops, ceiling sheathed with metal, which was not tight, and with joist channels not stopped off, fire worked into these concealed spaces, where water from sprinklers could not reach it, nor could streams from fire department and chemical engine be effectively used until a large portion of the sheathing had been torn off, and roof destroyed.

In buildings equipped with automatic sprinklers, sheathing should be tightly put together and kept in repair; all channels back of sheathing

should be closed between timbers or joists and concealed space in walls stopped on each floor.

At the best, sheathing that leaves concealed spaces is detrimental to sprinkler protection, as water from sprinklers cannot reach these spaces and fire may spread unchecked in back of the sheathing. Open finish is recommended. Where this is not practicable, on account of dust and dirt from floors above, sheathing should follow the contour of timbers and joists without concealed spaces.

S-10068. Tenant Manufacturing. Building was three stories high, of brick, slow-burning construction, with unprotected steel columns and floor I beams.

Steel beams and posts should be properly protected. This can easily be accomplished by covering with metal lath and plaster.

S-10256. Woolen Mill. Fire started between wooden sheathing and outer wall of the three-story frame addition of main building. It burned through outer wall before discovery, spreading up the side of a frame belt tower near by, and to roof of dry house.

Concealed space in walls should be tightly stopped off at each floor.

Fire Wall.

H-5376. Mercantile. Fire started in the grocery department on second floor of the brick building, and lapped around fire wall, entering third story of dry goods department.

Windows on either side of fire wall should be protected by approved fire shutters or metal window frames glazed with wired glass.

H-5394. Rolling Mill. The blank brick wall between blacksmith shop portion and pattern storehouse prevented what would have been a very serious loss on patterns. Fire was confined to blacksmith shop.

H-5438. Cotton Waste Mill. Fire was caused at 9 a. m. by foreign substance passing through picker. Picker was located in first story of building, cut off by a non-standard brick wall and fire doors. Door was carelessly left open, and fire passed through, spreading up through open area way to second story of boiler house, igniting stock stored therein, also spreading to open stock in main warehouse.

Brick wall cutting off picker room should be made standard, with openings equipped with standard automatic fire doors. Picker room should also be equipped with automatic sprinklers.

Floor Openings.

H-5522. Clothing Factory. Fire apparently started on a cutting table or work bench, spreading to floor above through opening in floor around a wooden post.

Floors should be tight around columns and at walls.

H-5584. Mercantile Building. Fire started in dry goods store, spreading up through elevator shaft, entering floor above through unprotected openings, also exposing and igniting adjacent hotel through rear windows and roof.

H-5589. Woodworker. Fire started on first floor from unknown cause, and extended through second, third, fourth and fifth floors, fire spreading through a wood-boxed belt hole. The damage to building on second, third and fourth floors was confined to space around belt hole. On fifth floor the damage was very heavy and the whole roof was practically burned off.

Belt enclosures passing through floors to be of non-combustible material.

Gate Valve.

S-10218. Shoe Factory. Fire was extinguished by the sprinklers and water pails. Fire department responded, but did not go into action. Fire department was unable to locate gate valve controlling sprinklers, and the pressure tanks (10,000 gallons capacity) were nearly emptied, and some water used from gravity tanks before sprinklers were shut off.

Open Sprinklers.

S-10081. Tenant Manufacturing. This building was exposed during the conflagration which originated in a lumber yard, and formed the southerly limit of the fire on the west side. The north, east and west sides of building were equipped with Walworth one-half inch orifice open sprinklers, one head over each window on the third and fourth floors. The heads were fed through four-inch connection from an eight-inch water works main. Valves in basement controlled the two three-inch risers for north and south sides, and also the two and one-half inch connection for the east side. When it was seen that the exposure fire was beyond control the valves for the north and east sides were opened, and the water curtain thus formed, aided by the twelve to sixteen-inch brick wall of the exposing building, effectually stopped the spread of fire in this direction. This curtain was in use from about 6.30 to 8 p. m., at which time the branch feed pipe for the north side was broken by the fall of the neighboring building wall. The water was still left on, however, because of the

protection it afforded. The exposure on the north was a basement and four story brick building, thirty feet distant, used for woodworking, which was completely demolished. On the east was the lumber yard, eighty feet distant, also a total loss. Spectators state that the work of the water curtain was excellent, it turning back the flames time after time, keeping the building so cool that not a sprinkler head opened, although the thermostat circuit sent in an alarm at 7.06, which may have been caused by water grounding the circuit.

The only damage was that due to water and broken glass, several of the tenants being wet down, and the basement more or less flooded. Loss estimated at $2,000.

Private Brigade.

H-5559. Foundry. Fire occurred in the joist roof over brick core ovens, located in corner of foundry. Roof slopes at this point being four to five feet above top of ovens at one end and from two to three feet at the other. The side walls and one end of ovens were carried up to roof, leaving an arched opening of considerable size into foundry at the remaining end.

Alarm was given upon discovery of fire, employees responding, using hose streams from yard hydrants. On account of the space above core ovens being bricked in on three sides, fire was inaccessible except from the foundry side, and for some reason this was overlooked, employees knocking holes through the walls, and using streams through these openings, losing much valuable time. Fire was extinguished after about half an hour's work, but not until roof boards, joists and beams had been so badly burned as to necessitate replacing. Fire department was not called.

Fire brigade should be familiar with the peculiarities of construction and occupancy of every building in plant. During practice a different building could be selected each time and hose streams placed to cover all parts.

Private Protection.

H-5411. Metal Worker. Fire was discovered during the afternoon on the wooden gravity tank platform, which was supported by joists on two steel girders and steel trestle. Fire was undoubtedly caused by sparks from adjacent foundry. Two hose lines from fire pump were immediately used, but fire was not extinguished until it had burned through a number of the joists and badly charred the bottom of the wooden sprinkler system tank. The joists supporting the 40,000-gallon tank were so weakened that tank leaked badly, only retaining about 18,000 gallons.

Iron supports and platform are to be used on the trestle when new tank is installed.

H-5415. Manufacturing Insulating Material. For several years owner's attention had been called to the need of inside and outside hose service for the protection of his buildings. This he failed to install.

The superintendent states that fire could have been extinguished at discovery had there been one good hose stream available. Loss approximately $96,000.

H-5497. Foundry. Fire occurred in foundry in front of core ovens. Watchman gave alarm, and then fought fire with hose streams until public department arrived. Loss $500.

H-5537. Glass Works. Alarm of fire was given about 4.20 a. m. The engineer at once started the fire pump, and night employees, under direction of superintendent of plant, used the hose service. Superintendent ran a length of hose to point of fire in building, but was driven back by dense smoke. The frame ventilators in roof of building served as smokestacks, and fire soon burned through roof. Ten hose streams in all were used. The fire pump gave excellent results, water pressure and supply being good. The deep well pumps, filling reservoir, were started and fire pump had an ample water supply to draught from. Fire was mainly fought over the roofs of adjacent buildings, as building itself could not be entered. Owing to the light frame construction, fire was soon beyond control, and shortly afterwards practically the entire building collapsed. Efforts were then devoted to extinguishing same and saving stock in nearby yard and adjacent buildings. There was no public protection in the town. Private brigade did efficient work in confining fire to building in which it started.

H-5601. Lumber Yard. Employees held the exposure fire in check with inside hose connections and prevented fire from entering their lumber shed or opening sprinklers.

S-10209. Furniture Factory. Woodworking machinery was equipped with an efficient blower system, which fed shavings direct to boilers, excess to shavings vault. Fire occurred in blower system, spreading into cyclone separator on roof. This was extinguished by a line of hose carried onto roof and directed into same. Water ran through conveyor pipes, flooding boiler room. Had fire been of longer duration this would probably have seriously hampered firing of boilers and operation of fire pump.

Fire pumps should be so located as to be free from damage by fire or other cause. If not practicable to locate fire pump in a detached fire resistive pump house, pump should be located in a clean well-floored room, with tight roof, having standard cut off from the remainder of plan.

Shavings conveyor system should be so arranged as to eliminate the danger of conducting water into boiler room, endangering steam supply for fire pumps.

S-10222. Laundry. Fire occurred from unknown cause at 12.15 a. m., on the second floor of laundry occupied for ironing, sorting and

storage, originating in a box of soiled white coats. Watchman passed through room on his 12 a. m. round, and noticed nothing wrong. Later, noticing smoke issuing from window, he ran to second floor, first pulled the auxiliary fire alarm, and then used the hose on two-inch standpipe. He held fire in check until assistance arrived, when chemical extinguishers were used, extinguishing fire before arrival of fire department. One sprinkler opened. Loss small.

S-10249. Metal Working. Fire occurred at 6 p. m., on the second floor of the tenant manufacturing building occupied for metal working. Employees had left when tenant occupying part of the same floor discovered smoke coming from the room. He immediately broke open the door, and threw what water there was in the nearby fire pails upon the flames which were spreading up the window frames. A standpipe hose stream was then used, extinguishing fire before arrival of fire department. No sprinklers were opened.

S-10309. Grain Elevator. Fire originated in a wheat-cleaning machine, caused in all probability by a nail or some foreign substance falling into the machine, causing a spark which ignited the dust. The fire traveled up through the metal dust pipe and cyclone collector, then through the vent-pipe to the outside. This metal vent-pipe passed up from the receiving floor through an empty bin, equipped with two sprinkler heads, to the bin floor. The heat from the pipe in the bin opened a head, which protected the woodwork next to the pipe. The fire was confined entirely inside the metal pipe.

The greatest damage was done by water, as the men in the elevator used two high pressure hose streams, wetting the grain in nineteen bins, or a total of 42,600 bushels of wheat, 5,000 bushels wheat screenings and 4,000 bushels of oats.

The fire was extinguished before the city fire department arrived.

Public Protection.

H-5418. Furniture Factory. Factory was located on the outer edge of city, about a mile and a quarter from fire department and half a mile from alarm box. Lightning struck factory, burning out phone, and igniting building. Watchman ran to the fire alarm box and gave alarm, but by the time fire department arrived buildings were well afire. There was only one hydrant within reach of the property.

H-5525. Pottery. Hydrants near plant were found plugged with mud at time of fire. This caused a serious loss.

H-5540. Brick Making. City fire department was handicapped through deficient water pressure. The six-inch water main supplied an ice manufacturing plant nearby, which greatly depleted water supply.

A main of larger capacity should be installed.

Steam Jet Protection.

H-5547. Tannery. Fire occurred in the two story hog mill (wood breaker) building, caused by foreign material passing through hog mill. Two hose streams from fire pump were immediately used, and steam jets in chute turned on. Owner states that steam jets practically extinguished the fire. One chute was well charred, but there was no loss.

S-10077. Wholesale Drug House. The room in which fire occurred was of fire resistive construction, located under driveway, and communicating with the five story building of plank and timber construction; opening was cut off by a single metal-clad wooden door. The room was twenty feet square, and used for the storage of oils, turpentine and one barrel of benzine. Room was protected by a Grinnell sprinkler installed on a one-inch steam pipe connected to the boiler.

Fire was probably caused by spontaneous combustion of oily material which caused a slight explosion. The steam head promptly opened, filling the room with steam, practically extinguishing fire.

Water Pails.

S-9883. Knitting Mill. Fire started in picker, caused by a nail in rags passing through machine. Employee heard click of metal, and seeing smoke shut door to gauze room and stopped machine. One pail of water extinguished fire, and machine was in operation again shortly.

S-10067. Electrical Appliances. Fire caused by hot soldering iron left against a piece of waste. Employee extinguished same with fire pail before sprinklers operated.

S-10241. Linen Mill. Fire was caused by foreign substance in card causing a flash fire, spreading over six cards. The employees immediately used pails of water, about twenty in all, quickly extinguishing fire. No sprinklers were opened, or hose streams used.

S-10245. Warehouse. Fire caused by wooden boxes against smoke flue in basement. Employees gave alarm, and then fought fire with water pails, holding fire in check. Fire department completed extinguishment with a chemical stream. No sprinklers opened.

Specifications, Rules and Requirements

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SUBJECTS.	Last edition.
Acetylene Gas Machines and Storage of Calcium Carbide	1910
Coal Gas Producers (pressure and suction systems)	1908
Electric Wiring and Apparatus, Installation Rules (Nat'l Electrical Code)	1909
Electrical Fittings, List of Approved	April, 1910
Fire Departments, Private	1902
Fire Doors and Shutters	1908
Fire Extinguishers, Chemical (for other than fire department use)	1909
Fire Hose, for fire department use	1909
Fire Hose, for private department mill yard use	1909
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1908
Fire Pumps (electric)	1904
Fire Pumps (centrifugal)	1909
Fire Pumps (rotary)	1909
Gas and Gasolene Engines	1910
Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1910
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Gravity Tanks	1910
Hose Couplings and Hydrant Fittings, for public fire service	1908
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Nitro-Cellulose Films (storage and handling)	1910
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Oxy-Acetylene Heating and Welding Apparatus	1910
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Systems, used for the transmission of signals affecting the fire hazard	1907
Skylights	1906
Sprinkler Equipments, automatic and open systems	1910
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements ("slow-burning" construction, "inferior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1906
Valves, Indicator Posts and Hydrants, for mill yard use	1910
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1909

A copy of each revised edition of the above pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

Approved Devices and Materials.

There are listed below in form convenient for reference by members the names and addresses of manufacturers of devices and materials which have thus far been favorably passed upon by the Devices and Materials Committee, following examinations, tests and recommendations made by Underwriters' Laboratories, Inc.

The Laboratories have also issued reports giving ratings unfavorable to a large number of appliances. A summary of the findings in each case can be obtained by addressing the Laboratories and any Active or Associate member can receive regularly the cards issued by the Laboratories giving summaries of the results obtained in the current work in all of its departments upon payment of the subscription price of fifteen dollars ($15) per year.

In the lists which follow members should note particularly that in those industries to which the label service has been extended (indicating inspection of goods by Laboratories' engineers at factories before shipment) **only such of the product of these factories as bear the labels referred to** are covered by the endorsement of the Committee.

BUILDING MATERIAL.

ASBESTOS BUILDING LUMBER.

Asbestos Lumber manufactured by the following company is considered from the insurance viewpoint as superior to wood for the uses intended.

Ambler, Pa., Keasbey & Mattison.

BLOCKS FOR PARTITIONS.

Hollow Pyrobar Partition Blocks made of pure gypsum (plaster of paris) and wood fibre. Provided with 3 x 4 round, tapering core holes. Three to 5 inches in thickness, 12 inches wide and 30 inches long. Shells 7-16 to 1 3-8 inches and webs 13-16 to 1 inch in thickness.

When set on incombustible foundation, laid with broken joints in properly retarded gypsum plaster, and coated on each side with wood fibered gypsum plaster at least 1-2 inch in thickness, these blocks are **approved** for use in non-bearing corridor and room partitions not exceeding 13, 17 and 22 feet in height for the 3, 4 and 5 inch blocks respectively, in fireproof office buildings and buildings of this class, but **not** for bearing walls or partitions, nor for enclosures to stairways and elevators or important vertical openings through buildings.

The following company manufactures this material:

Chicago, United States Gypsum Company, 200 Monroe Street.

PARTITIONS.

Made of Perfected Brand Sackett Plaster Board and gypsinite studding.

Sackett boards composed of three layers of pure gypsum (plaster of paris) and four thin layers of wool felt, formed into slabs or sheets 3-8 inch in thickness and 32 x 36 inches in size. Each board stenciled "Sackett Patented May 22, 1894."

Gypsinite studding composed of pure gypsum fibered with wood and reinforced with two 1-2 x 2 inch wood nailing strips. Studs 3 inches square and furnished in lengths up to and including 12 feet.

Partitions composed of these studs spaced 16 inches, with cross pieces at top, bottom and middle, fastened together with No. 26 gage galvanized steel clips; covered with Sackett

plaster boards attached to the studs by No. 10, 1-2 x 1-2 inch flat head, 3-4 barbed wire nails, 1 3-4 inches long, spaced not exceeding 6 inches; coated on each side with fibered gypsum plaster laid to 3-4 inch grounds.

Tests and investigations at Underwriters' Laboratories show that for heights not exceeding 12 feet, non-bearing partitions constructed as described possess somewhat higher fire retardant properties than partitions composed of wooden studding and wooden lath and fibered gypsum plaster or lime plaster; but these properties are not sufficiently higher to entitle this partition to a classification for corridor and room partitions in fireproof buildings, or for the enclosure of important vertical openings through buildings.

The following company manufactures this material:

New York, Sackett Plaster Board Co., 1123 Broadway.

SLOTTED STEEL STUDDING FOR PARTITIONS.

Studding for 3, 4 and 5 inch hollow partitions. Studding made of No. 18 U. S. gage open hearth steel, in the form of channels 1 7-8, 2 3-8 and 3 3-8 inches in width. Spaced 11 3-4 inches apart, and attached to each other by strips punched from the center of the studs, thus forming horizontal braces at 17 inch intervals. Each stud provided with a shoe at bottom and extension piece at upper end for attaching direct to floors and ceilings, or to No. 16 gage steel channels, separately fastened to floors and ceilings at 48 inch intervals.

When securely anchored to incombustible floors and ceilings, provided with extension pieces lapping at least 3 inches, lathed on both sides with 3-4 by 1-2 inch diamond mesh expanded metal, at least No. 26 U. S. gage in thickness, tied to studs and at laps with No. 18 gage galvanized tie wire spaced 6 inches; and coated on both sides with fibered gypsum plaster laid to at least 3-4 inch grounds, the 1 7-8, 2 3-8 and 3 3-8 inch galvanized and painted studs are **approved** for use in non-bearing, corridor and room partitions not exceeding 15, 20 and 25 feet in height respectively, in fireproof office buildings and buildings of this class, but **not** for bearing walls or partitions, nor for enclosures to stairways and elevators or important vertical openings through buildings.

The following company manufactures this material:

Sharon, Pa., Sharon Steel Hoop Company.

SACKETT PLASTER BOARD.

"Perfected Brand." Composed of three layers of pure gypsum (plaster of paris) and four thin layers of wool felt, formed into slabs or sheets 3-8 inch in thickness and 32 x 36 inches in size. Each board stenciled "Sackett Patented May 22, 1894." Boards attached by No. 10, 1-2 x 1-2 inch flat head, 3-4 barbed wire nails, 1 1-4 inches long, spaced not exceeding 6 inches at each support.

Tests and investigations at Underwriters' Laboratories show that this board is a suitable base for fibered gypsum plasters, and when attached as described to walls and ceilings, and plastered, its fire retardant properties are somewhat higher than those of wooden lath and fibered gypsum plaster, or wooden lath and lime plaster, in buildings in which wooden studding, joist and furring are used; but these properties are not sufficiently higher to entitle the board to a materially better classification as a fire retardant.

The following company manufactures this material:

New York, Sackett Plaster Board Co., 1123 Broadway.

SAGAX WOOD.

Made of ground straw, a cement binder and a few other ingredients, the exact composition being regarded as a trade secret.

Laboratory tests indicate that this material is non-combustible, a good non-conductor of heat, and when made in large sections of sufficient thickness is only slightly injured by high temperatures and the subsequent application of water. It absorbs moisture slowly, is considerably heavier and more brittle than wood and can be worked with ordinary woodworking tools.

The following company manufactures this material:

Baltimore, Md., Sagax Wood Co.

POST CAP AND GIRDER SUPPORT (STEEL AND MALLEABLE IRON).

Caps inspected at factory bear structural material labels attached to an exposed side reading as follows:

The following companies are equipped to supply these devices:

Chicago, A. M. Castle & Co., 217–221 N. Jefferson Street.
Cleveland, The Duplex Hanger Co., Cleveland.

WALL HANGER (STEEL).

Hangers inspected at factory bear above structural material labels attached to an exposed side.

The following company is equipped to supply this device:

Cleveland, Ohio, The Duplex Hanger Co.

CANS, Waste.

Waste cans shown by examination conducted by Underwriters' Laboratories, Inc., to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., have labels attached reading:

The following companies are equipped to supply these devices:

Cincinnati, The Witt Cornice Co., 2118–2124 Winchell Avenue.
St. Louis, Handlan-Buck Mfg. Co., 210 N. Third Street.
St. Louis, Missouri Lamp and Mfg. Co., 114–116 Elm Street.

The following waste can was listed before the inauguration of the label service covering this character of device and may be recognized by the trade name given:

Chicago, F. Cortez Wilson & Co., 239 Lake Street, "Nacefas."

DOORS AND SHUTTERS.

STANDARD TIN-CLAD FIRE DOORS AND SHUTTERS.

Standard Tin-Clad Fire Doors, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

Standard Tin-Clad Fire Shutters, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

Standard 2-ply Tin-Clad Fire Doors for stairs or elevators shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass labels reading:

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if

any, of fire door will be accepted in the location desired and should make contracts subject to approval by them of the sill, frame, hardware, installation and automatic attachments.

The following companies are equipped to supply these devices:

Akron, O., The Kasch Roofing Co., 16-24 Canal Street.
Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg.
Aurora, Ill., National Fire Door Co.
Beaumont, Texas, J. T. Booth.
Boston, George T. McLauthlin Co., 120 Fulton Street.
Brooklyn, Hiram A. Akerly, 173 Berry Street.
Buffalo, Chas. Bauers' Sons, 159 William Street.
Buffalo, Philip Christmann & Sons, Corner Virginia and Orange Streets.
Buffalo, Dusing & Hunt, 76 Main Street.
Buffalo, Machwirth Bros. Co., 201–209 Oak Street.
Buffalo, G. H. Peters & Co., 289–293 Oak Street.
Buffalo, F. J. Tingler & Son, 121 W. Eagle Street.
Chicago, Knisely Bros., Fifth Avenue and 28th Place.
Chicago, Lyon Fire Door Co., 1741-3 Walnut Street.
Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue.
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues.
Cincinnati, The M. Marcus Building Co., 1513–21 Plum Street.
Cincinnati, J. H. Shields, 231 Sycamore Street.
Cleveland, J. Callaghan & Son, 1119 Superior Avenue, near Twelfth Street, N. E.
Cleveland, Cleveland Metal Roofing & Ceiling Co., 3103–3105 Detroit Avenue.
Cleveland, Cleveland Sheet Metal Works, 6933–5 Superior Avenue.
Cleveland, Mannen & Esterly Co., 2241–2255 St. Clair Avenue, N. E.
Cleveland, The O'Donnell Safety System Co., 3062 Superior Avenue, N. E.
Cleveland, The Ohio Roofing Co., 1477 Euclid Avenue.
Cleveland, Riester & Thesmacher Co., 325–329 Pearl Street.
Cleveland, Rudolph & Sons Co., 1416–1420 Prospect Avenue, N. W.
Columbus, Kinnear & Gager Mfg. Co., 326 Mt. Vernon Avenue.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Columbus, F. O. Schoedinger, 146-148 N. 3d Street.
Denver, G. W. Brown, 1135 14th Street.
Galveston, Texas, Texas Sheet Metal Works, 2624–2626 Mechanic Street.
Hoboken, N. J., The Leonard Sheet Metal Works, 215–221 Grand Street.
Holyoke, Mass., Coburn Trolley Track Manufacturing Co.
Kansas City, Geo. W. Johnson Mfg. Co., 209–11 W. 17th Street.
Louisville, Ky., E. G. Heartick, 915 East Broadway.
Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street.
Milwaukee, Biersach & Niedermeyer Co., 220 Fifth Street.
Milwaukee, Consolidated Sheet Metal Works, 661–673 Hubbard Street.
Milwaukee, R. Jeske & Bro., 111-119 Reservoir Ave.
Milwaukee, E. B. Tonnsen, 51-53 Third Street.
Minneapolis, Northwestern Roofing, Cornice and Stamping Works, 1113 S. Fifth Street.
Minneapolis, Selden Roofing and Manufacturing Co.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215–1219 Washington Avenue, North.
Minneapolis, Variety Fire Door Co., 123 Western Avenue.
Newburyport, Mass., Victor Manufacturing Co.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburgh Street.
New Orleans, Estate of R. G. Holzer, 317–323 Burgundy Street.
New Orleans, A. J. Nelson Manufacturing Co., Ltd.
New Orleans, New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Sts., and Carrollton Avenue.
New York, J. F. Blanchard Co., 23d St. and Broadway.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Knoburn Co., 27 East 22d Street.
New York, Manhattan Fireproof Door Co., 412–422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, M. F. Westergren, Inc., 213–221 E. 144th Street.
Oklahoma City, Arthur R. Moore Sheet Metal Co., 113 California Avenue.
Omaha, Omaha Safe & Iron Works, 10th and Dodge Streets

Paterson, N. J., Hugh C. Lendrim Co.
Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue.
Pittsburg, Perritt Iron & Roofing Co., 6 Brushton Avenue.
Richmond, Ind., Richmond Safety Gate Co.
San Francisco, Forderer Cornice Works, 16th Street and Potrero Avenue.
San Francisco, Rulofson Metal Window Works, 315–319 Monadnock Building.
San Francisco, San Francisco Cornice Co.
South Bend, Ind., Indiana Lumber and Mfg. Co.
St. Louis, Albert & Fischer Hardware & Sheet Metal Co., 2529 South Broadway.
St. Louis, Caplan Galvanized Iron Cornice Co., 4412-4414 Easton Avenue.
St. Louis, J. Eberle & Son, 2014–2016 Laclede Avenue.
St. Louis, Gerock Bros. Mfg. Co., 1352 Old Manchester Road.
St. Louis, O. K. Harry Steel Works, 2333–5 Papin Street.
St. Louis, Frank B. Higgins, 924 North Sixth Street.
St. Louis, Hopmann Cornice Co., 2500–2 North Jefferson Avenue.
St. Louis, A. L. Krauss Sheet Metal Works, 4260 Easton Avenue.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street.
St. Louis, Missouri Fire Door Co., 100 South Commercial Street.
St. Louis, E. Murphy & Co., 3727–3731 Easton Avenue.
St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–16 Laclede Avenue.
St. Louis, Richmond Safety Gate Co., 1117 Chemical Building.
St. Louis, Ruth Cornice Co., 4299 Easton Avenue.
St. Louis, St. Louis Fire Door Co., Cass and Collins Streets.
St. Louis, E. E. Souther Iron Co., 2206 North Second Street.
St. Louis, Standard Fire Door and Contracting Co., 3025 Texas Avenue.
St. Louis, Van der Au & Cluss Mfg. Co., 2408 So. Jefferson Avenue.
St. Louis, Wand & Niehaus, 3008 Kossuth Avenue.
St. Louis, West End Cornice Works, 4740 Delmar Boulevard.
St. Paul, Perkins Mfg. Co., Corner Fairview and University Avenues.
Toledo, O., The L. F. Burdick Co., 2011 Adams Street.
Toledo, O., J. L. Creswell, 120 N. St. Clair Street.
Toledo, O., Warnke Bros. Co.
Toronto, Ont., Can., Douglas Brothers, 124 Adelaide Street, West.
Toronto, Ont., Can., A. B. Ormsby, Ltd., 161–165 Queen Street, East.
West New York, N. J., A. J. Ellis.

METAL FIRE DOORS AND SHUTTERS.

Three-inch fire door, made of No. 24 U. S. gage crimped galvanized steel, in horizontal sections 8 inches wide, filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street.

METAL FIRE DOORS.

Two and one-half-inch fire door, made of No. 26-inch gage steel, galvanized, in horizontal sections 8 inches wide, filled with mineral fibre. Sections tongued and grooved at intersections and held together by 1-2 inch vertical rods spaced 18 inches, passing through 2 1-2 by 1 1-2 by 3-16 inch angle at top and 1-4 by 2 1-2 inch bar at bottom of door.

Doors of this type shown by tests and examinations at Underwriters' Laboratories, Inc., to be the equivalent of the standard 2 1-2-inch tin-clad door for the protection of openings in fire walls **not exceeding 80 square feet in area**, and examined at factory and

passed by Underwriters' Laboratories, Inc., are labeled by stampings in the plates or by attaching brass labels, as shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Columbus, Ohio, Kinnear Manufacturing Co., Columbus.

Door made of two thicknesses No. 22 U. S. gage corrugated galvanized sheet steel, with 1-16-inch sheet asbestos between. Corrugated steel sheets on opposite sides of door are bolted and riveted together only at edges. Doors stiffened by flat bars and galvanized iron channels at edges.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding six feet in width** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Memphis, Tenn., Saino Fire Door & Shutter Co., Tennessee Trust Building.

COMPOSITION FIRE DOORS.

Two-inch solid door made of Sagax wood reinforced by ½-inch round steel rods in both directions, located in middle of door. Rods interlaced and extend close to edges of door. Vertical rods spaced not exceeding 4 inches and twisted around 1-4-inch horizontal rod at top. Horizontal rods spaced not exceeding 6 inches.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard tin-clad door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

COMPOSITION FIRE SHUTTERS.

One and one-half inch solid shutter made of Sagax wood, reinforced by 1-8-inch round steel rods in both directions and a layer of expanded metal having 1 by 1-2 inch mesh. Vertical rods spaced not exceeding 9 inches and horizontal rods 11 inches apart. Reinforcing members located approximately midway between the surfaces of the door and extend to within one inch of all edges. Shutters provided with 3 hinges where in excess of 3 feet in width or 8 feet in height, and with ogee rabbet where they are made in pairs.

Shutters of this type shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to be the equivalent of standard tin-clad fire shutters for the protection of exterior openings, and examined at factory and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass labels as shown above.

The following company is equipped to supply this device. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

DOUBLE STEEL ROLLING FIRE DOORS.

For openings not exceeding 8 feet wide and 9 feet high where standard fire doors cannot be employed. Automatic double steel rolling doors, **mounted in reveal on each side of wall,** overlapping at sides. Spring counter-balanced. Curtains made of No. 16 U. S. gage galvanized open hearth steel slats, interlocked at edges.

Doors examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading:

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co. Marking, "Abacus No. 3."

STEEL ROLLING FIRE SHUTTERS.

Normally open automatic steel rolling shutter for exterior openings not exceeding 10 feet wide and 10 feet high.

Shutters examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading as shown above.

The following company is equipped to supply these devices:

Columbus, O., Kinnear Mfg. Co. Marking, "Abacus No. 4."

CORRIDOR OR PARTITION DOORS.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in corridors and partitions but **not for openings in fire walls** (see list of Fire Doors and Shutters) and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched brass labels attached to the back edge reading: (See Cut No. 1.)

This label is evidence of proper construction of the door at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of these doors will be accepted in the location desired, and should make contracts subject to the approval by them of sizes, mounting, hardware and frame.

The following companies are equipped to supply these devices in the types indicated:

METALLIC DOORS.

Bradford, Pa., American Metal Door Co. 1⅝-inch door, frame, trim.
Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door, frame, trim.
Chicago, Voigtmann & Co., 445 West Erie Street. 2-inch door, frame, trim.
Jamestown, N. Y., Art Metal Construction Co. 1⅝-inch door, frame, trim.
Jamestown, N. Y., Dahlstrom Metallic Door Co. 1½-inch door, frame, trim.
Minneapolis, Northwestern Roofing, Cornice & Stamping Works, 1113 S. Fifth Street. 2-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 13-16-inch door. Door only.
New York, John W. Rapp, 1 Madison Avenue. 1¾-inch door, frame, trim.
Youngstown, O., General Fireproofing Co. 2-inch door, frame, trim.

METAL-CLAD DOORS.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door only.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue. 1⅝-inch door, frame, trim.

Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 2½-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1¾-inch door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2½-inch door only.
New York, Howell & Lawrence, 1788 First Avenue. 1¾-inch door only.
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅝-inch door only. Known as "Standard A."
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅝-inch door only. Known as "Standard B."
New York, John W. Rapp, 1 Madison Avenue. 2-inch door, frame, trim.

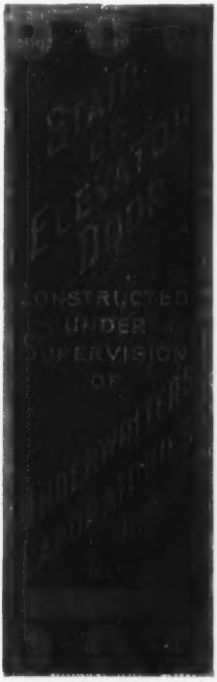
COMPOSITION DOORS.

Baltimore, Md., Sagax Wood Co., 106 Dover Street. 1¾-inch door and frame. Known as "Perfection."

STAIR OR ELEVATOR DOORS.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in **stair and elevator** enclosures **but not for openings in fire walls,** and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched labels attached to the back edge reading: (See Cut No. 2.)

Cut No. 1.



Cut No. 2.

The label is evidence of proper construction of the door at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of these doors will be accepted in the location desired and should make contracts subject to the approval by them of frame, sill, size, installation and automatic attachments.

The following companies are equipped to supply doors bearing these labels, the approval being restricted by the limitations specified in italics over each group.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and single swinging doors in pairs for openings not exceeding 72 inches in width, which when equipped with special hardware and mounted in special frames have been shown to be the equivalent of doors mounted in standard frames with standard hardware for this class of service.

Chicago, Knisely Bros., Fifth Avenue and 28th Place, 2-inch door and hardware.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and doors in pairs for openings not exceeding 72 inches in width, equipped with special hardware which when used in connection with these doors mounted in standard frames has been shown to be the equivalent of standard hardware.

Chicago, Knisely Bros., Fifth Avenue and 28th Place, 2-inch door and hardware.
Chicago, Voigtmann & Co., 445 W. Erie Street, 2-inch door and hardware.

METALLIC DOORS, not filled with wood.

Single swinging doors for openings not exceeding 48 inches in width and doors in pairs for openings not exceeding 72 inches in width when mounted in standard frames with standard hardware.

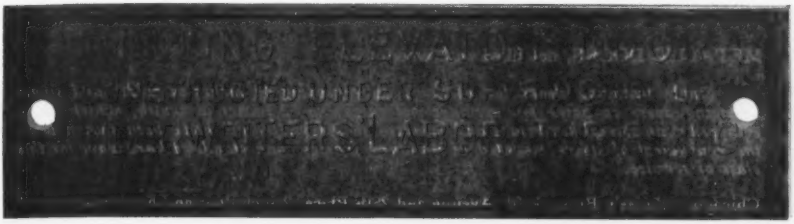
Bradford, Pa., American Metal Door Co., Bradford. 1¾-inch door.
Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door.
Chicago, Voigtmann & Co., 445 W. Erie Street. 2-inch door.
Jamestown, N. Y., Art Metal Construction Co. 1¾-inch door.
Jamestown, N. Y., Dahlstrom Metallic Door Co. 1 9-16-inch door.
Minneapolis, Minn., Northwestern Roofing, Cornice & Stamping Works, 1135 Fifth Street. 2-inch door.
New York, J. F. Blanchard Co., Broadway and 23d Street. 1 3-16 inch door.
New York, John W. Rapp, No. 1 Madison Avenue. 1¾-inch door.
Youngstown, O., General Fireproofing Co. 2-inch door.

METAL-CLAD WOOD DOORS.

Chicago, Knisely Bros., Fifth Avenue and 28th Place. 2-inch door.
Minneapolis, Thorp Fire Proof Door Co., 1600–1616 Central Avenue. 2¼-inch door.
New York, J. F. Blanchard Co., Broadway and 23d Street. 2¼-inch door.
New York, Howell & Lawrence, 1788 First Avenue. 1¾-inch door.
New York, Manhattan Fireproof Door Co., 412–422 E. 125th Street. 1¾-inch door. Known as "Standard A."
New York, John W. Rapp, 1 Madison Avenue. 2-inch door.

STEEL ROLLING DOORS.

Automatic steel rolling elevator doors examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by brass labels attached to bottom bar reading as follows:



The following companies are equipped to supply doors bearing these labels, the approval being restricted by the limitations specified in italics over each group.

Automatic steel rolling elevator doors for openings not exceeding 8 feet in width and 9 feet in height, in shafts which do not communicate with more than one fire section. Doors mounted on face of wall.

Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Door known as "Variety No. 33."
Columbus, Kinnear Mfg. Co., Columbus. Door known as "Abacus No. 1."
New York, J. G. Wilson Mfg. Co., factory at Norfolk, Va. Door known as "Wilson Arrangement No. 1."

Automatic steel rolling elevator doors for openings not exceeding 8 feet in width and 9 feet in height, in standard shafts which communicate with more than one fire section, and in non-standard shafts which communicate with more than one fire section when the opening in wall is additionally protected by a standard fire door.

Columbus, Kinnear Mfg. Co., Columbus. Door known as "Abacus No. 2."

EXTINGUISHERS, HAND CHEMICAL, 3 Gallon.

Carbonic Acid Gas Hand Fire Extinguishers shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Board of Fire Underwriters and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder, reading:

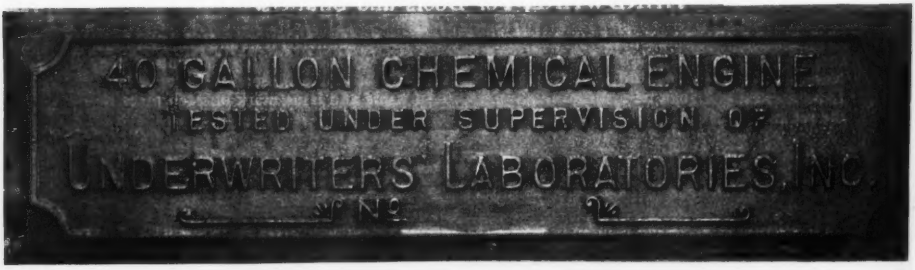
The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction under what conditions extinguishers of this type will be accepted and should make contracts subject to approval by them of setting, distribution and number to be used in respect to floor area.

The following companies are equipped to supply these devices:

Ansonia, Conn., Metropolitan Fire Extinguisher Co., 1133 Broadway, N. Y.
Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Boston, Knight & Thomas, Inc., 99 State Street.
Boston, The Standard Extinguisher Co., 78 Portland Street.
Buffalo, Buffalo Chemical Fire Extinguisher Co., 154 Ellicott Street.
Buffalo, Western Inspection Co., 45 N. Division Street.
Chicago, Miller Chemical Engine Co., 220–222 W. Huron Street.
Chicago, Staff Fire Extinguisher Co., 543–545 Orleans Street.
Cincinnati, Harker Mfg. Co., 118 W. Second St.
Columbus, Seagrave Company, South High Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.
Minneapolis, Minn., Northern Fire Apparatus Co., 1301–1307 Third Street, South.
Montreal, Can., The Garth Co., 26–32 Craig Street, West.
Newark, N. J., The Tea Tray Company of Newark, N. J., Mulberry and Murray Streets.
Petrolia, Ont., Canada, Stempel Mfg. Co., Ltd., Petrolia.
Philadelphia, James Boyd & Bro., 25th and Wharton Streets.
Pittsburg, Fire Extinguisher & Supply Co., 1414–1422 Spring Garden Avenue, N. S.
Pittsburg, Pittsburg Lamp, Brass & Glass Co., Foot of Locust St.
Portland, Me., Conqueror Fire Extinguisher Co., 120 Exchange Street.
Racine, Wis., Racine Iron & Wire Works, 1022 Douglas Avenue.
St. Louis, Frank & St. Gemme Mfg. Co., 815–817 Market Street.
St. Louis, Missouri Lamp and Mfg. Co., 116 Elm Street.
St. Louis, Stempel Fire Extinguisher Mfg. Co., 4250 North 20th Street.
Toronto, Canada, Victor Fire Extinguisher Company, 704 Continental Life Building.
Utica, O. J. Childs Co., 50 Liberty Street.

EXTINGUISHERS ON WHEELS, CHEMICAL, 40 Gallons.

Carbonic Acid Gas Fire Extinguishers of 40 gallons capacity mounted on wheels, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder reading:



The following companies are equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Elmira, N. Y., American-LaFrance Fire Engine Co., Elmira.

EXTINGUISHERS, Miscellaneous.

WAGGONER SANATORY FIRE BUCKET.

This pail as submitted complies with the rules of the National Board of Fire Underwriters in details of construction and is designed in a manner which effectually protects its contents from evaporation and foreign matter.

Where it is designed to protect the contents of exposed pails against freezing by the addition of calcium chloride or other salts Underwriters having jurisdiction should be consulted.

The following company manufactures this bucket:

Chicago, Ill., Waggoner Sanatory Fire Bucket Co., 1340 West Lake St.

FUSIBLE LINK.

Links examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each box of 100 links, sealing the box, reading as follows:

The following manufacturer is equipped to supply this device for use in connection with automatic closing devices for doors and windows, and automatic devices requiring fusible links where the loads to which the links are subjected do not exceed the following:

5 lbs. where a factor of safety of 5 is required.
6 1–4 lbs. where a factor of safety of 4 is required.
8 1–3 lbs. where a factor of safety of 3 is required.

Chicago, Voigtmann & Co., 445–459 W. Erie Street.

GLASS. (See Wired Glass.)

HARDWARE, For Doors and Shutters.

Standard $3\frac{1}{2}$x$\frac{5}{8}$-inch hardware for *sliding fire doors* only, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll reading as follows:

A tag is also attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One $3\frac{1}{4}$x$\frac{3}{4}$-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two $3\frac{1}{4}$x$\frac{3}{4}$-inch binders. 4. One $2\frac{1}{8}$x$\frac{1}{8}$-inch stay roll. Stay roll should be the type specified for the form of sill used and should include

all bolts except wall bolts. 5. One cast-iron bracket for each track bolt. 6. Two ¾x⅛-inch half oval chafing strips for back of door, two 1x⅛-inch flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1½x⅛-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. Note: Each bumper shoe made in two pieces 12. One washer for each wall bolt, including those for binders and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type of hardware will be accepted in the location desired and should make contracts subject to approval by them of the fire door equipment complete, including sill, mounting and automatic attachments.

The following companies are equipped to supply this hardware:

Aurora, Ill., Richards Mfg. Co. Marking, "Monarch A."
Aurora, Ill., Wilcox Mfg. Co. Marking, "Wilcox 501 A."
Boston, Geo. T. McLauthlin Co., 120 Fulton Street. Marking, "McLauthlin A."
Cleveland, O'Donnell Safety System Co., Corner Superior Avenue and 31st Street, N. E. Marking, "O'Donnell A."
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Marking, "Variety A."
Holyoke, Mass., Coburn Trolley Track Mfg. Co. Marking, "Coburn A."
Newburyport, Mass., Victor Mfg. Co. Marking, "Victor A."
New York, The McCabe Hanger Mfg. Co., 425–427 W. 25th Street. Marking, "'A' McCabe."
Philadelphia, Jas. Peters & Son, 1934–38 N. Front Street. Marking, "Peters A."
Richmond, Richmond Safety Gate Co. Marking, "A. Richmond."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co., Marking, "No. 20–A Wilbern."
St. Louis, Mesker & Bro., 421-519 South Sixth Street. Marking, "Mesker & Bro. 'A'."

* * * * * *

Specially designed malleable iron hardware for *sliding fire doors*, which is considered to be the full equivalent of the 3½x⅝-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 1 7-16-inch tubular track, length to be equal to twice the width of door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width, three hangers for openings wider than six feet, and bolts for attaching hangers to door. 3. Two malleable iron binders. 4. One malleable iron stay roll. 5. Brackets to carry track, including two special end supports. 6. Two ¾x⅛-inch half oval chafing strips for back of door, two flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through the door. Length of above strips to be 4 inches less than door opening. 7. One 2¼x⅛-inch strip 5 inches less than width of door to take wear of stay roll, with wood screws for attaching. 8 One malleable iron wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. Note: Each bumper shoe made in two pieces. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Chicago, Allith Manufacturing Co., Taylor Street and 43d Avenue. Marking, "Allith A-06."
Hamilton, Can., Allith Mfg. Co. Marking, "Allith H."

Specially designed malleable iron hangers, tubular steel track and malleable iron brackets for *sliding fire doors*, which are considered to be the full equivalent of 3½x⅝-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, approved in combination with the balance of the set of standard 3½x⅝-inch steel hardware and examined at factory and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of pieces which a complete set should contain, as follows:

1. One 1¾-inch tubular steel track, length to be equal to twice the width of the door opening plus 14 inches. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x¾-inch binders. 4. One 2½x½-inch stay roll. Stay roll should be the type specified for the form of sill used, and should be provided with all bolts except wall bolts. 5. Malleable iron brackets for carrying track, including two special end supports, which are also designed to act as front and back bumpers respectively. 6. Two ¾x¼-inch half oval chafing strips for back of door; two flat strips for front of door opposite chafing strips. Bolts for fastening strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1¼x½-inch strip 5 inches less than width of door. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. Four bumper shoes and screws for attaching. [*Note:* Each bumper shoe made in two parts.] 11. One washer for each wall bolt, including those for binders, bumpers and stay roll. 12. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Aurora, Ill., Wilcox Manufacturing Co. Marking, "Wilcox No. 645."

. . . . . .

Hardware for *sliding metal fire doors* filled with mineral fibre, which is considered to be the full equivalent of the 3½x⅝ inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by labels applied to each hanger, binder and stay roll of each set, as shown above.

A special tag is attached to one hanger of each set, on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 3½x¾-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to doors. 3. Two 3½x¾-inch binders. 4. One 2½x½-inch stay roll. 5. One cast-iron bracket for each track bolt. 6. Two ¾x¼-inch half oval chafing strips for back of door. Length of strips to be four inches less than door opening. 7. One 1½x½-inch strip to take wear of roller guide, provided with $\frac{3}{16}$-inch counter-sunk holes spaced 5½ inches apart. 8. One cast-iron wedge with machine screws for attaching. 9. One bow-shaped handle, and one flush pull with 2¾-inch cap screws and two ¾-inch counter-sunk machine screws for attaching. 10. One front bumper and one back bumper. 11. Two binder shoes and machine screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll.

Where the hardware for a single fire door on each side of the wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length varies in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Columbus, Ohio, Kinnear Manufacturing Co. Marking, "Kinnear A."

. . . . . .

Standard hardware for single 2 1-2 inch *swinging fire doors*. Mounted on face of wall.

Standard hardware for single 2 1-2 inch swinging fire doors shown by tests and examinations made by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Under-

writers' Laboratories, Inc., can be distinguished by labels applied to each wall strip for hinges, each wall strip for catches, and connecting bar for latches, of each set reading as shown above.

A special tag is also attached to one hinge of each set, on which is printed a list of the pieces which a complete set should contain, as follows:—

1. Three 2 1-2 x 1-2 inch wall eyes attached to 2 1-2 x 1-4 inch wall strip. 2. Three 2 1-2 x 3-8 inch hinges, 1-2 inch carriage bolts for attaching. 3. Three 2 x 3-8 inch catches attached to 2 1-2 x 1-4 inch wall strip. 4. Three 1 1-2 x 3-8 inch latches attached to 1 1-2 x 1-4 inch connecting bar. Two door plates and two 5-16 inch machine bolts for each latch. 5. Two handles with 1-2 inch spindle and 1-4 inch triangular plate for operating. 6. Three keepers with six 3-8 inch machine bolts for attaching. 7. One latch spring with adjusting rod and 1 1-4 x 1 1-4 x 3-16 inch angle piece. No. 12 wood screw for attaching. 8. Six 4-inch cast iron washers for wall bolts. 9. One instruction card for mounting.

Where the hardware for a single fire door on each side of the wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length varies in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this type of hardware:

Chicago, Variety Manufacturing Co., Carroll and Sacramento Avenues. Marking, "Variety A."

HANGERS ONLY.

Specially designed adjustable malleable iron hanger for *sliding fire doors*. Approved only in combination with a complete set of approved fixtures for sliding doors, and in locations where an adjustable hanger is acceptable to Underwriters having jurisdiction. Hangers examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark and by labels shown above.

The following companies are equipped to supply this hardware:

Chicago, Allith Mfg. Co., W. Taylor and S. 43rd Ave. Marking "Allith No. 6."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "Wilbern No. 4A."

HARDWARE FOR WINDOWS.

SASH LOCKS.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories Inc., have attached to each box of **twelve locks,** sealing the box, label reading as follows:

The following manufacturers are equipped to supply these devices:

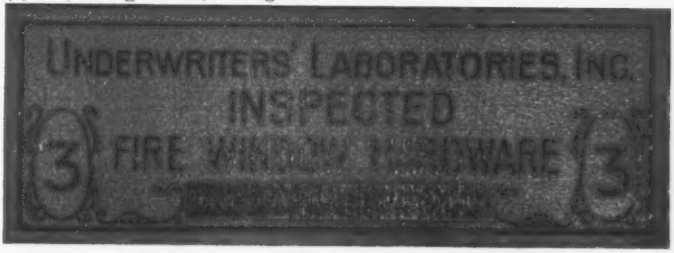
Chicago, Payson Manufacturing Co., 2918 Jackson Boulevard.
New Haven, Conn., The H. B. Ives Co., 11–17 Artizan Street.

Gravity Locks for Pivoted Windows examined at factory and passed by Underwriters' Laboratories Inc., have attached to each box of **three locks,** sealing the box, label reading as above, except the figure 3 appears on the label instead of 12.

The following manufacturer is equipped to supply these devices:

Philadelphia, Pa., Jas. Peters & Son, 1934–1938 North Front Street.

Pivots and Gravity Locks for pivoted windows examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each box of three (3) sets, sealing the box, reading as follows:



The following company is equipped to supply these devices:

Newark, N. J., Frank F. Smith, 19 Division Street.
New York, J. W. Yates, 156 9th Avenue.

. . . . . .

Sash tilting and locking mechanism for manually operated windows examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by label attached to each package, in such a manner that the label will be destroyed in opening, reading as above.

Complete set consists of two balance arms and fittings, four sash guide pins, two switches, two groove plates, two latches and two catches. These parts are approved for use in connection with labeled windows especially designed for this type of hardware in locations where an automatic closing feature is not required by the Underwriters having jurisdiction.

The following company is equipped to supply these devices:

Philadelphia, Pa., Austral Window Balance Co., 1326 Chestnut Street.

SASH CHAINS.

The following sash chains in the sizes indicated have been examined and tested and are approved for use on metallic window frames and sash with wired glass as follows:

Bridgeport, Conn., Bridgeport Chain Co. Hot Galvanized Steel Sash Chain, looped type.

Size No. 1 for sash weighing not more than 80 pounds.
Size No. 2 for sash weighing not more than 130 pounds.
Size No. 3 for sash weighing not more than 195 pounds.

Oneida, N. Y., Oneida Community, Ltd. Community Guaranteed Sash Chain, galvanized steel, loop type.

Size No. 80 for sash weighing not more than 90 pounds.
Size No. 100 for sash weighing not more than 120 pounds.
Size No. 130 for sash weighing not more than 160 pounds.
Size No. 250 for sash weighing not more than 210 pounds.

HEAT INSULATING COVERINGS.

CORK BOARD (Nonpareil) LAID IN CEMENT MORTAR.

Two-ply construction, consisting of two layers of 2-inch Nonpareil corkboard bedded in ½-inch layers of cement mortar and covered with a ½-inch finish coating of the same material.

This material is approved for heat insulating purposes for walls, floors and ceiling, in cold storage warehouses, cold storage cellars in breweries, cold rooms in packing houses, hotel refrigerators, fur storage rooms and rooms of this character.

The following company manufactures this material:

Pittsburg, Pa., Armstrong Cork Co.

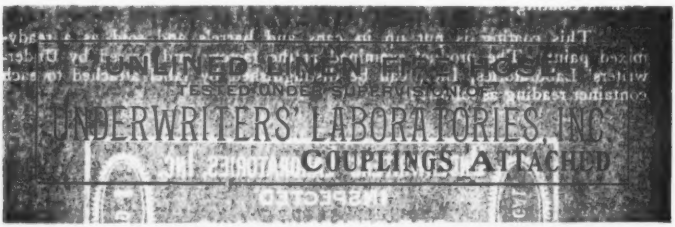
HOSE.

COTTON RUBBER-LINED.

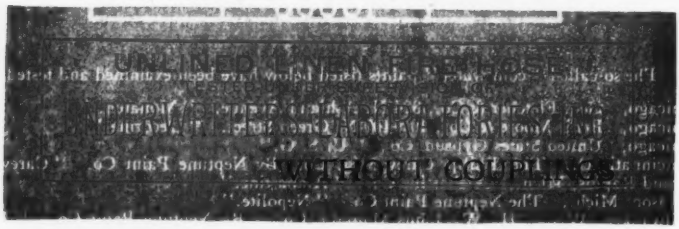
Owing to the present attitude assumed by the manufacturers in this industry no general approvals are extended to these goods. The Underwriters' Laboratories label service is available for use in this industry and users may arrange for tests at the Laboratories under the National Standard specifications.

UNLINED LINEN.

Unlined Linen Fire Hose for use inside buildings shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each length **with couplings attached** reading as follows:



Laboratory Labels, on hose shipped from factories **without** couplings attached, read:



The following companies are equipped to supply this material:

Lawrence, Mass., Wm. and Chas. Beck.
Malden, Mass., Chas. Niedner's Sons Co., 10 James Street.
New York, Eureka Fire Hose Mfg. Co., 13 Barclay Street.

HYDRANTS.

Until such time as results of tests of fire hydrants under the revised specifications are secured, this device is believed to be as suitable for the puposes intended as others of its class.

Indian Orchard, Mass., Chapman Valve Mfg. Co.

PAINTS, FIRE RETARDANT.

These coatings for wood and other similarly combustible building materials which come under this class, or property so coated, should in no sense be considered as "fireproof." Their use is preferable to leaving the material uncoated, because they retard the spread of fire over combustible surfaces and are particularly desirable in lieu of varnish, shellac, or oil finish, which latter serve to rapidly spread fire. Attention is called, however, to the need of renewal of the coatings in order to maintain the desired conditions.

Whitewash so well meets the requirements of this class that we print formula recommended by the Lighthouse Board of the United States Treasury Department as follows:

"Slake one-half bushel of unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when used put it on as hot as possible with painter's or whitewash brushes."

Where possible the coatings should be applied by a hand brush rather than by a spraying machine, thus effecting a better surface, and special care should be exercised not to coat sprinkler heads where installed.

Boston, Wadsworth, Howland & Co., 82–84 Washington Street. Bay State Brick and Cement Coating.

This coating is put up in cans and barrels and sold as a ready-mixed paint. The product examined at the factory and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each container reading as follows:

The so-called "cold water" paints listed below have been examined and tested.

Chicago, Geo. Fletcher & Co., 324 N. Ashland Avenue. "Monarch."
Chicago, Benj. Moore & Co., 401–409 N. Green Street. "Decorine."
Chicago, United States Gypsum Co. "U. S. G."
Cincinnati, O., The Philip Carey Mfg. Co. By Neptune Paint Co. "Carey's."
Grand Rapids, Mich., Alabastine Co. "Alabastine."
Hudson, Mich., The Neptune Paint Co. "Nepolite."
Milwaukee, Wis., H. W. Johns-Manville Co., By Neptune Paint Co. "J. M."

Milwaukee, Wis., Retardo Fire Proof Paint Co., By Benj. Moore & Co. "Retardo."
New Brighton, S. I., N. Y., The Muralo Co., "Asbestine." "Indeliblo." "Indurine."
New York, N. Y., M. Ewing Fox & Co., 136th Street and Rider Avenue. "Fox's Interior Permanite."

PLAY PIPE.

The National Standard Play Pipe for 2½-inch hose manufactured by the following company has been examined and tested and is approved for use:

New York, Eureka Fire Hose Manufacturing Co., 13 Barclay Street.

PUMP GOVERNOR.

The "Boardman" pump governor for control of National Standard Steam Fire Pumps manufactured by the following company has been examined and tested and approved for use.

Salem, Mass., Locke Regulator Co.

RECEPTACLES.

These receptacles commonly designated as "Safety Cans" are designed for the storage and handling of open stock of benzine, gasolene, naphtha, and other inflammable fluids. While not reducing the dangerous character of the fluid which they contain, they are considered as mitigating the extremely dangerous conditions attending the storage and handling of inflammable fluids in the common light sheet metal and glass receptacles generally used for this purpose.

Receptacles examined at factories and passed by Underwriters' Laboratories, Inc., have metal labels attached reading as follows:

The following companies are equipped to supply these devices:

Chicago, Geo. W. Diener Mfg. Co., 400-416 Monticello Avenue.
Milwaukee, Imperial Safety Can Co.

ROOFINGS.

Certain proprietary roofings listed below have been examined and tested.

These tests indicate that the fire retardant properties of these materials are inferior to those of slate, metal or good tin-clad roofs, but in a class with those of good slag and good gravel roofs, and superior to those of wooden shingle roofs.

Aurora, Ill., Usona Mfg. Co. Usona Burlap Center Asphalt. Usona Gravel Surfaced. Usona Pebble Top Asphalt.
Boston, Mass., J. A. & W. Bird & Co., 35 India Street. Mikado (2 and 3 ply). Rex Flintkote (2 and 3 ply).
Chicago, Amalgamated Roofing Co., Manhattan Bldg. Amalgamated Arc Rubber (2 and 3 ply). Amalgamated Arc Flint (2 and 3 ply).
Chicago, F. Becker Asphaltum Ready Roofing Co., 1510-12 Milwaukee Avenue. Becker Asphaltum Ready Roofing (2 and 3 ply).
Chicago, Elaborated Ready Roofing Co., 4419 La Salle Avenue. Elaborated Ready Roofing.

Chicago, Ford Manufacturing Co., 2335-2341 La Salle Street. Eclipse Rubber, Ford Prepared (3 ply). Galvanized Rubber.
Chicago, The Heppes Co., 4500 Filmore Avenue. Carbonite (2 and 3 ply). Flexo (2 and 3 ply). No-Tar (2 and 3 ply). Rubbertex (2 and 3 ply).
Chicago, The Lehon Mfg. Co., W. 43rd Street, Lincoln to Robey. Roofrite.
Chicago, The Patent Vulcanite Roofing Co., 1288 S. Campbell Avenue. Vulcanite (2 and 3 ply).
Chicago, Rubbertex Cloth & Paper Co., Commercial National Bank Bldg. Lonabond.
Chicago, Sall Mountain Asbestos Mfg. Co., 234 La Salle Street. Reliance Rubber (2 and 3 ply).
Chicago Heights, Ill., Paraffine Paint Company. Cronolite (2 ply).
Cincinnati, O., Philip Carey Mfg. Co. Carey's Standard Magnesia Flexible Cement.
Denver, Col., Western Elaterite Roofing Co., 841–4 Equitable Building. Elaterite.
East St. Louis, Ill., All Roofing Manufacturing Co. Armco (2 ply).
East St.Louis, Ill., The General Roofing Mfg. Co. Rubber (2 and 3 ply).
East Walpole, Mass., F. W. Bird & Son. Paroid (2 and 3 ply).
Edwardsville, Ill., National Roofing Materials Co. Mastic.
Erie, Pa., H. F. Watson Co. Indruroid (2 and 3 ply).
Houston, Texas, The Texas Company. Texaco Felt (2 and 3 ply).
Jersey City, N. J., Stowell Mfg. Co. Monarch (2 and 3 ply). Stowell's Slag.
Muscatine, Iowa, Huttig Mfg. Co., by Barber Asphalt Paving Co. Huttig Rubber (2 and 3 ply).
New York, Asphalt Ready Roofing Co., 136 Water Street. Arrow Brand Asphalt Ready Roofing (2 ply). Protection Brand Asphalt Ready Roofing. Stonehenge (2 ply).
New York, Barrett Mfg. Co., 17 Battery Place. Black Diamond (2 and 3 ply). Amatite. Amazon Ready (2 and 3 ply).
New York, The Eastern Granite Roofing Co., 1 Hudson Street. Granite.
New York, H. W. Johns-Manville Co., 100 William Street. Standard Asbestos. Brooks Brand Asbestos (3 and 4 ply). J. M. Regal (2 and 3 ply).
New York, Standard Paint Co., 100 William Street. Ruberoid (2 and 3 ply).
New York, Warren Chemical and Manufacturing Co., 17 Battery Place. Rhinoceros (2 and 3 ply). Walrus (2 and 3 ply).
Philadelphia, The Barber Asphalt Paving Co. Genasco Smooth Surface (2 and 3 ply). Genasco Whitestone (2 ply). Genasco Stone. Genasco Model.
Philadelphia, The Buchanan-Foster Co., 504 West End Trust Bldg. Congo (2 and 3 ply).
Philadelphia, Warren-Ehret Co., 1202 Land Title Bldg. Ehrets (Slag).
San Francisco, Cal., The Paraffine Paint Co., Merchants' Exchange Bldg., Malthoid (2 and 3 ply).
South Bend, Ind., McHenry-Millhouse Mfg. Co. Climax Asphalt (2 and 3 ply). Veribest Rubber (2 and 3 ply).
St. Louis, Mo., Roofbestos Mfg. Co. Roofbestos (2 ply).
St. Paul, Minn., Union Roofing and Mfg. Co. Gal-va-nite.
Tonawanda, N. Y., National Roofing Co. Crystalite. Diamond Grit. Liberty. National. Safety. Security. Sparkloid (2 and 3 ply). Standard.
Waukegan, Ill., The West Coast Company. West Coast Ready Rock.
York, Pa., Keystone Roofing Mfg. Co. X-L-Oid Rubber Roofing (2 and 3 ply).

SASH CHAIN. (See Hardware for Windows.)

SASH LOCK. (See Hardware for Windows.)

SHUTTERS. (See Doors and Shutters.)

SIGNAL AND FIRE ALARM SYSTEMS, BELLS FOR.

The following devices have been examined and are approved.

New York, Stanley & Patterson, 23 Murray St. Faraday (weather proof and skeleton type.)

SPRINKLERS, AUTOMATIC.

The following automatic sprinklers have been examined and tested under the rules and requirements of the National Board of Fire Underwriters and are approved for use:

Crowder, Issue A. Crowder Bros., 309 Merchants-Laclede Bldg., St. Louis, Mo.
Grinnell Improved 1903. General Fire Extinguisher Co., Providence, R. I.
International, Issue B. International Sprinkler Co., 517 Arch Street, Philadelphia, Pa.
Manufacturers, Issue C. Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York.
Neracher Improved 1902. General Fire Extinguisher Co., Providence, R. I.
Niagara-Hibbard, Issue B. Niagara Fire Extinguisher Co., Akron, O.
Rockwood, Issue C. Rockwood Sprinkler Co., 4 Arch Street, Worcester, Mass.

SPRINKLER SUPERVISORY DEVICES.

For use in connection with approved central station systems.

Consists of apparatus for transmitting signals when gate valves are closed or open; when water in tanks falls below or is restored to predetermined level; when pressure in air tanks falls below or is restored to predetermined amount; when water in tanks falls below or rises above predetermined temperatures. Also apparatus for connection with water flow valves to transmit water flow signals (where there is a flow of water equal to that of one or more sprinklers) and to withhold signals from water surges or variable pressures.

A. D. T. Devices for attaching to Central Station Signaling Systems for supervisory maintenance and operation of sprinkler equipments.
New York and Chicago. Automatic Fire Protection Company.

THERMOSTATS.

AUTOMATIC FIRE ALARMS.

These systems utilize the principle of the expansion under heat of air contained in a small copper tube which is installed along ceilings or piping. Tube leads to contact closing and test devices of special type. The expansion of air in tube actuates a diaphragm closing an electric circuit whereby signal is transmitted.

These devices as sold by the following companies are **approved** subject to the following conditions:

1. Underwriters having jurisdiction to be consulted in all cases before installations are made.
2. Tubing to be installed to comply as to location, distribution and spacing with requirements for thermostats of electric automatic fire alarms.
3. Central station equipments, local equipments, electric devices and circuits and other portions of this system other than the tubing and the pneumatic devices connected with it to comply in all respects with the requirements for similar portions of automatic fire alarm systems.
4. Labels. Tubing for these systems constructed according to approved specifications and examined and tested at factory under the supervision of Underwriters' Laboratories, Inc., bears tag reading: "Underwriters' Laboratories, Inspected Tubing for Automatic Fire Alarm, No. . . . . ." One such tag for each 100 feet of tubing installed should be preserved in transmitter case at risk as permanent record of tubing used. Each Detector, Annunciator and Transmitter for this system constructed according to approved specifications and examined and tested at factory under supervision of Underwriters' Laboratories, Inc., bears metal label reading: "Underwriters' Laboratories, Inspected Automatic Fire Alarm Device, No. . . . . ."

Denver, Colorado. Frederick Thomas, Coronado Building, Agent for United States and Canada for English Patentees. "Aero."

New York. American District Telegraph Co., 195 Broadway. "Compensating."

VALVES, ALARM. (See also Sprinkler Supervisory Devices.)

No appliances meeting all of the requirements desirable for this service have as yet been shown.

Ratings covering the patterns found in common use have been issued as follows:

Evans Variable Pressure 1902 model. Manufactured by International Sprinkler Co., 517 Arch Street, Philadelphia. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell English Pattern, Variable Pressure (Swing check or Straightway type). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell branch (old type called Harkness Tee). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Manufacturers. Manufactured by Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Niagara. Manufactured by Niagara Fire Extinguisher Co., Akron, O. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Rockwood Variable Pressure. Manufactured by Rockwood Sprinkler Company, Worcester, Mass. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed and intelligently supervised.

Venturi. Manufactured by Venturi Alarm Co., Dover, N. J. Not standard. Field experience limited and not wholly satisfactory.

VALVES, DRY PIPE.

For use in connection with Automatic Sprinkler Equipments.

The following dry pipe valves have been examined and tested and are approved for use:

Grinnell Straightway, 4, 5 and 6-inch sizes. The General Fire Extinguisher Company, Providence, R. I.

International (No. 4 Evans Model), 4-inch and 6-inch sizes. International Sprinkler Co., Philadelphia, Pa.

Manufacturers (Model 3), 4-inch and 6-inch sizes. Manufacturers' Automatic Sprinkler Co., New York, N. Y.

Niagara (1909 Model), 4-inch and 6-inch sizes. Niagara Fire Extinguisher Co., Akron, O.

Rockwood, 4-inch and 6-inch sizes. Rockwood Sprinkler Co., Worcester, Mass.

WASTE CANS. (See Cans, Waste.)

WATCHMEN'S TIME RECORDING APPARATUS.

Users of the following Time Recording Apparatus should in all cases consult local Underwriters having jurisdiction concerning the particular type of appliance or system to be used, the number and location of stations, character and installation of wiring, methods to be followed in receipt and disposition of signals, keeping of records, rendering reports, and all other details having a bearing on proper installation, maintenance and use.

The label is evidence of proper construction of the devices at the factories.

BOXES FOR CENTRAL STATION SYSTEMS.

Combined Watchmen's Call and Fire Alarm Boxes for use in connection with approved normally closed circuit Central Station Watchmen's Time Recording Apparatus, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the rules of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the outside of the clock cases reading:

The following companies are equipped to supply these devices:

Baltimore, Viaduct Electric Co., 10 S. Howard Street.
Milwaukee, Signalphone Company.
New York, American District Telegraph Co., 195 Broadway.
Washington, The Williams Company, Stewart Building.

APPARATUS FOR LOCAL OR PRIVATE SYSTEMS.

Watchmen's Time Recorders shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to outside of clock cases reading:

and a decalcomania transfer is applied to the outside of the clock station cases reading:

The following companies are equipped to supply these devices of the types listed below:

Boston, Eco Magneto Clock Co., 236 Congress Street. Stationary with magnetos, circular dial and cylindrical dial types. Portable.
Boston, E. Howard Clock Co., 373 Washington Street. Stationary with magnetos, circular dial and cylindrical dial types.
Brookline, Boston, Holtzer-Cabot Electric Co. Stationary with magnetos, circular dial.
Buffalo, The Jaynes Electrical Co., 806 Main St. Stationary with magnetos, circular dial.
Chicago, Chicago Watchman's Clock Works, 58-60 Wabash Avenue. Portable.
Chicago, Newman Clock Co., 1526 Wabash Avenue. Stationary, single station type. Portable.
Chicago, The Timekeeper Co., 1524 Wabash Avenue. Portable.

Chicago, Hardinge Bros., 3135 Lincoln Avenue. Portable, double dial and single dial types with plunger keys; single dial type with steel key.
Cleveland, American Watchman's Time Detector Co., E. 35th St. and Perkins Ave. Stationary with magnetos, circular dial types.
Gardner, Mass., Simplex Time Recorder Co. Stationary with magnetos, cylindrical dial type.
Grand Rapids, Mich., E. A. Hamilton & Co. Stationary with magnetos, circular dial type.
Jersey City, Manhattan Electrical Supply Co. Magnetos only, for stationary clocks.
New York, American Watchman's Time Detector Co., 234–5 Broadway. Stationary with magnetos, circular dial type.
New York, Edwards & Company, 140th and Exterior Sts. Stationary with magnetos, circular dial type.
New York, General Watchman's Time Detector Co., 27 Pine Street. Portable.
New York, E. O. Hausberg, 45 Maiden Lane. Stationary with magnetos, circular dial type. Portable.
New York, Nanz Clock Company, 178 Fulton Street. Portable.
New York, Standard Watchman's Time Detector Co. (W. Romaine), 1-3 West Broadway. Stationary with magnetos, circular dial type.

WINDOWS.

Window Frames for Wired Glass, shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., bear metal labels riveted in place, reading:

The label is evidence of proper construction of the appliance at the factory. Prospective users should first ascertain from the Underwriters having jurisdiction which type, if any, of wired glass windows will be accepted in the location desired, and should make contracts subject to approval by them of the installation, glazing and automatic attachments.

The following companies are equipped to supply these devices, which when properly installed and equipped are approved for protection against moderate exposures in openings not exceeding 5 feet by 9 feet.

Atlanta, Ga., Dowman-Dozier Mfg. Co., 605 Rhodes Bldg. Double Hung.
Baltimore, Md., The C. D. Pruden Co., Warner, Dock and Bayard Streets. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.
Boston, Mass., E. B. Badger & Sons Co., 63 Pitts Street. Double Hung, Stationary (2 types); Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Pivoted Upper and Double Hung Lower Sash.
Boston, Mass., E. Van Noorden Co., 100 Magazine Street. Double Hung; Pivoted Upper Sash; Single Pivoted Sash.
Brooklyn, N. Y., Herrmann & Grace, 671–685 Bergen Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Buffalo, N. Y., Machwirth Bros. Company, 201–209 Oak Street. Pivoted Upper Sash; Pivoted Upper and Lower Sash.

Chicago, Ill., Grace Cornice Works, 1260 Indiana Avenue. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., Illinois Roofing & Cornice Co., 1144 West Kinzie Street. Double Hung; Stationary; Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., Knisely Bros., Fifth Avenue and 28th Place. Double Hung; Stationary; Casement; Top Hinged; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., Harry C. Knisely Co., 506 So. Canal St. Double Hung; Twin Double Hung Sash; Stationary; Twin Stationary Sash; Top Hinged Sash; Top Hinged Upper and Stationary Lower Sash; Twin Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Pivoted Upper and Two Stationary Sash; Pivoted Middle Sash; Stationary Upper and Lower.

Chicago, Ill., J. C. McFarland & Co., 27th Street and Fifth Avenue. Double Hung; Stationary; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Chicago, Ill., James A. Miller & Bro., 114–116 So. Clinton Street. Double Hung; Stationary; Twin Stationary Sash; Top Hinged Sash; Twin Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Chicago, Ill., Perkinson & Brown, 413–415 N. Lincoln Street. Double Hung; Twin Double Hung Sash; Stationary; Twin Stationary; Top Hinged Sash; Twin Top Hinged; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Chicago, Ill., E. A. Rysdon & Co., 527 W. 41st Street. Double Hung; Stationary; Top Hinged; Top Hinged Upper, Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Upper and Lower Sash Pivoted and Middle Sash Stationary.

Chicago, Ill., Sykes Steel Roofing Co., 930 W. 19th Place. Double Hung; Twin Double Hung Sash; Stationary (two types); Top Hinged (two types); Twin Top Hinged Sash; Pivoted Upper Sash (two types); Pivoted Lower Sash (two types); Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Twin Pivoted Upper Sash.

Chicago, Ill., Voigtmann & Co., 445–459 W. Erie Street. Double Hung (two types); Stationary; Twin Stationary Sash; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Pivoted Middle and Stationary Upper and Lower.

Chicago, Ill., W. D. Watson Co., 1037 W. Van Buren Street. Stationary; Top Hinged; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, The Edwards Mfg. Co., Eggleston Avenue, 4th and 5th Streets. Double Hung; Pivoted Upper Sash.

Cincinnati, Ohio, Jacob Freund Roofing Co., B. & O. S. W. Ry., near Mitchell Avenue. Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, Thomas Lee, 128 W. Second Street. Double Hung; Stationary; Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cincinnati, Ohio, Witt & Brown, 215 West 3d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Cleveland, Ohio, Ohio Roofing Co., 1477 Euclid Avenue. Double Hung.

Cleveland, Ohio, Riester & Thesmacher Co., 1514–1526 W. 25th Street. Double Hung (two types); Counterbalanced; Stationary; Pivoted Upper Sash (two types); Pivoted Lower Sash; Single Pivoted Sash.

Cleveland, Ohio, The Rudolph & Son Co., 416-420 Prospect Ave., N. W. Double Hung; Pivoted Upper Sash.

Columbus, Ohio, F. O. Schoedinger, 146–148 North 3d St. Double Hung (two types).

Detroit, Mich., W. J. Burton Co., 164–166 West Larned Street. Double Hung.

Galveston, Texas, Texas Sheet Metal Works, 2624–2626 Mechanic Street. Double Hung.

Hoboken, N. J., Leonard Sheet Metal Works, 215-221 Grand Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Kansas City, Mo., Monarch Metal Mfg. Co., 1722 Tracy Avenue. Double Hung; Twin Double Hung; Stationary; Twin Stationary; Top Hinged; Twin Top Hinged; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

Kansas City, Mo., J. A. Ritzler Cornice & Ornament Co. Double Hung; Pivoted Upper Sash.

Kansas City, Mo., Henry Weis Cornice Co., 1811-1815 Wyandotte Street. Double Hung; Twin Double Hung Sash; Counterbalanced; Stationary; Twin Stationary; Top Hinged Sash; Pivoted Upper Sash (two types); Pivoted Lower Sash; Pivoted Upper and Lower Sash (two types); Single Pivoted Sash (two types); Twin Pivoted Sash.

Kansas City, Mo., Zahner Mfg. Co., 310–316 West 20th Street. Double Hung (two types); Top Hinged Sash; Stationary (two types); Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Lebanon, Pa., C. Bressler & Co. Double Hung.

Los Angeles, Cal., California Cornice Works, 1610–1614 San Fernando Street. Double Hung.

Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street. Double Hung; Stationary; Twin Stationary; Top Hinged; Hinged Upper and Fixed Lower; Fixed Upper and Top Hinged Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Milwaukee, Wis., Biersach & Niedermeyer Co., 216–220 Fifth Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

Milwaukee, Wis., Consolidated Sheet Steel Metal Works, 661 Hubbard Street. Double Hung; Twin Double Hung Sash; Stationary; Hinged Sash; Twin Hinged Sash; Hinged Upper and Stationary Lower Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Single Pivoted Basement Sash; Pivoted Upper Basement Sash; Three Pivoted Sash; Pivoted Upper and Lower, Stationary Middle Sash; Pivoted Middle, Stationary Upper and Lower Sash; Pivoted Lower, Stationary Upper and Middle Sash; Pivoted Upper, Double Hung Lower Sash; Pivoted Upper, Stationary Middle and Lower Sash; Special Mullion Windows.

Minneapolis, Minn., Crittenden Roofing & Mfg. Co. Double Hung.

Minneapolis, Minn., Northwestern Roofing, Cornice & Stamping Works, 1113 Fifth St. Double Hung.

Minneapolis, Minn., Selden Roofing & Mfg. Co., 76 Western Avenue. Double Hung.

Minneapolis, Minn., Stremel Bros. Roofing and Cornice Co., 1215–1219 Washington Avenue, N. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New Orleans, La., American Sheet Metal Works, Carrollton Avenue and Edinburgh Street. Double Hung; Stationary; Twin Stationary Sash; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.

New Orleans, La., A. J. Nelson Mfg. Co. Double Hung; Stationary; Top Hinged Sash; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New Orleans, La., New Orleans Roofing and Metal Works. Double Hung.

New York, N. Y., J. F. Blanchard Co., Fuller Building, Broadway and 23d Street. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.

New York, N. Y., The Geo. Hayes Co., 71 Eighth Avenue. Pivoted Upper Sash.

New York, N. Y., S. H. Pomeroy Co., Inc., 427 W. 13th Street. Double Hung (two types); Twin Double Hung Sash; Stationary; Twin Stationary Sash; Counterbalanced Sash; Casement; Top Hinged Sash; Top Hinged Upper and Stationary Lower; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash; Three Pivoted Sash; Two Pivoted and Stationary Lower Sash; Special Mullion Windows.

New York, N. Y., M. F. Westergren, Inc., 213–221 E. 144th Street. Double Hung; Pivoted Upper Sash (two types); Pivoted Upper and Lower Sash.

Philadelphia, Pa., David Lupton's Sons Co., Allegheny Avenue and Tulip Street. Double Hung; Twin Double Hung Sash; Stationary Sash; Casement; Top Hinged Sash Opening in; Top Hinged Sash Opening out; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Twin Pivoted Sash.
Philadelphia, Pa., Lyster Sheet Metal Co., 1218–1220 Filbert St. Double Hung.
Philadelphia, Pa., The J. S. Thorn Co., 20th and Allegheny Avenue. Double Hung (two types); Counterbalanced Sash; Stationary Sash; Casement; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.
Pittsburg, Pa., Allegheny Cornice & Skylight Co., 821 Boquet Street, N. S. Double Hung; Twin Double Hung Sash.
Pittsburg, Pa., Thos. W. Irwin Mfg. Co., 401-411 Rebecca Street, N. S. Double Hung; Pivoted Upper Sash.
Pittsburg, Pa., Keighley Metal Ceiling & Mfg. Co. Double Hung; Stationary Sash; Top Hinged; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash.
Pittsburg, Pa., Rasner & Dinger Co., Second Ave. and Ferry St. Double Hung; Pivoted Upper Sash.
Salem, O., W. H. Mullins Co. Double Hung (two types); Stationary; Pivoted Upper Sash; Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Three Pivoted Sash.
San Antonio, Tex., T. P. Walsh. Double Hung.
San Francisco, Cal., Forderer Cornice Works, corner Potrero Avenue and 16th Street. Double Hung (two types); Stationary; Pivoted Upper Sash (two types); Pivoted Lower Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash.
San Francisco, Cal., The Rulofson Metal Window Works, 315–319 Monadnock Building. Double Hung; Pivoted Upper Sash.
San Francisco, Cal., San Francisco Cornice Co., Bryant between 9th and 10th Streets. Double Hung; Pivoted Upper Sash; Single Pivoted; Double Pivoted; Special Mullion Windows.
St. Louis, Mo., Eagle Metal Works, 1510–1512 Clark Avenue. Double Hung; Stationary; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Pivoted Upper and Double Hung Lower Sash; Single Pivoted Sash.
St. Louis, Mo., Hopmann Cornice Co., 2571–2573 Benton Street. Double Hung.
St. Louis, Mo., Mesker & Bro., 421–519 So. Sixth Street. Double Hung; Double Hung Lower Sash with Stationary Transom; Double Hung Lower Sash with Hinged Transom; Double Hung Lower Sash with Pivoted Transom; Stationary; Top Hinged; Casement; Casement Sash with Stationary Transom; Casement Sash with Hinged Transom; Casement Sash with Pivoted Transom; Pivoted Upper Sash; Pivoted Upper and Lower Sash; Single Pivoted Sash; Vertical Pivoted Sash.
St. Louis, Mo., Powers & Boyd Cornice and Roofing Co., 3614–3616 Laclede Avenue. Double Hung.
St. Louis, Mo., John F. Ruth Cornice Works, 4298 Page Avenue. Double Hung; Pivoted Upper Sash.
St. Louis, Mo., Von Der Au & Cluss Mfg. Co., 2404–2408 South Jefferson Avenue. Double Hung.
St. Paul, Minn., St. Paul Roofing and Cornice Co. Double Hung.
Toronto, Ont., Douglas Bros., Ltd., 128 Adelaide Street N. Double Hung.

WINDOW HARDWARE (See Hardware for Windows.)

WIRED GLASS.

Wired glass manufactured by the following companies is approved for protection against moderate exposures, when used in sizes not exceeding 720 square inches and with neither dimension in excess of 48 inches, and provided with distinctive marking as noted:

Wired glass protection is not equivalent to that furnished by standard fire doors and shutters except for moderate exposures. Notice is called to the need of using standard frames and glazing and glass of the required thickness.

New York, N. Y. Mississippi Wire Glass Co.
Marking: This company claims exclusive right to the use of hexagonal mesh in wired glass. Decision of the court of last resort on this claim is not yet reported. In the meantime sub-standard wired glass using hexagonal mesh is occasionally found on the market. Members should therefore make careful inspection of this type of product before acceptance.

Philadelphia, Pa. Pennsylvania Wire Glass Co.
Marking: Consists of a strand of the wire mesh made by twisting two No. 27 gage wires together, and spacing such distinctive cabled strand approximately 10 inches apart in each sheet of glass manufactured.

Streator, Ill. Western Glass Co.
Marking: Consists of five loops at each vertical strand of wire mesh.

Washington, Pa. Highland Glass Co.
Marking: Consists of a double strand of wire at intervals of 9½ inches. The two wires of the double strand are not twisted together except at the twisted portions of the mesh.

FOR USE IN CONNECTION WITH BURGLAR ALARM EQUIPMENTS.

Wired glass designed for use in connection with burglar alarm equipments.

One-fourth inch wired glass with series of parallel wires about ½-inch apart, approximately midway between surfaces. Submitted as possessing some value as a fire retardant.

When mounted in standard window frames with lights not in excess of 48 inches, this glass is approximately 50 per cent as efficient as standard wired glass for protection against moderate exposure.

The following company manufactures this material:

New York, N. Y. Mississippi Wire Glass Co., for American District Telegraph Co.' 195 Broadway.